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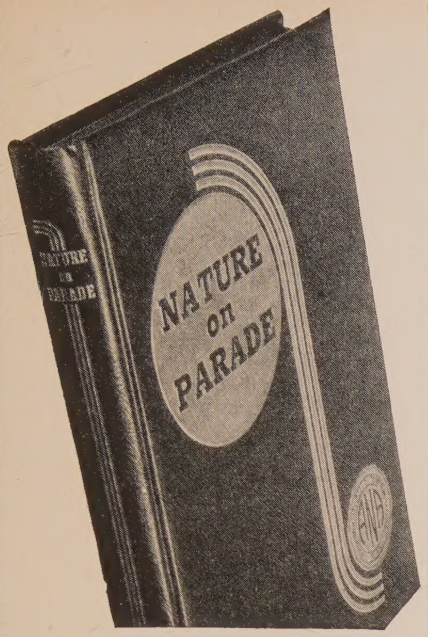

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Conservation Text

The increasing number of popularly-presented conservation books is further increased by the publication of *Pandora's Box* by Marian E. Baer. Written in simple and straightforward fashion, this book should serve well for use in junior and senior high schools as a text or for collateral reading in social science courses. Miss Baer gives a good general picture of the situation confronting our renewable or organic natural resources today. She is, at times, somewhat superficial, possibly due to the limitations of space. At other times her text reveals a none too broad and penetrating knowledge of the whole conservation picture. It is a complex subject, of course, and many of the points involved in it are controversial. Miss Baer has rather well avoided the latter, but often seems to fail to realize the complexity of the subject and neglects to suggest to the reader the need for further exploration of specific questions. The book is not as logically planned as it might be, the author emphasizing the interrelation of things in the Nature scheme but failing to apply this fact to the book's plan. Although we could wish that Miss Baer's definite abilities to present a subject such as conservation in interesting fashion had been better bulwarked by a grasp of the subject, this book does have its place among conservation texts. It is published by Farrar and Rinehart at two dollars.

Scientific Excursions

The General Electric Company has brought popular science into thousands of homes through the medium of radio, and by drawing upon the work of the many men in the company's research laboratory. Now the material presented over the air is available in a more permanent form in a book entitled *Excursions in Science*. Edited by Neil B. Reynolds and Ellis L. Manning, this book presents thirty-five popularly-written chapters in the field of science. They are contributed by thirty different scientists, almost all of them now connected with General Electric. This is a book for the layman and its themes range from astronomy to vacuums, from archaeology to optics. Published by Whittlesey House, this fascinating excursion into popular science sells for $2.50.

Want to Exchange?

The Kiamichi Club, a natural history and museum club of the Idabel High School, Idabel, Oklahoma, is anxious to exchange natural history specimens with similar groups throughout the United States. The club has herbarium specimens, reptiles, amphibians, fossils, tree fruits, stems and leaves and would like to receive marine material, amphibians, reptiles and mollusca. Willis W. Collins is the sponsor of the club for the school faculty.

Science Meeting

The National Council on Elementary Science will hold its annual meeting in St. Louis on February 24, the Saturday preceding the meeting of the American Association of School Administrators of the National Education Association. The meeting will be held in the Crystal Room of the Jefferson Hotel. The entire program will deal with science in the elementary school.

Sells 19 Features In Six Months

"I have sold, up to date, nineteen features to the Detroit Free Press and have been made their correspondent here," writes Mrs. Leonard Sanders of 1432 Putnam Ave., Detroit, Mich. on completing the N.I.A. course. Her skilful handling of feature stories was the reason given by the editor for her appointment. Mrs. Sanders' first feature was sold less than four months after she enrolled with N.I.A.

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Camera Trails

BY NORRIS W. HARKNESS

FEBRUARY PHOTO CONTEST WINNERS. ABOVE, DOVE ON NEST BY E. FRED MILLER, ST. LOUIS, MO. BELOW, ARCTIC FOX AT DEN IN ALASKA BY VICTOR B. SCHEFFER, SEATTLE, WASH.

Working with Snow

At this time of year the Nature photographer, in the northern part of the country at least, is limited almost entirely to two types of pictures—snow scenes of one sort or another and indoor pictures of plants and aquariums. Let us consider the kinds of things we may find outdoors and some of the things we need to remember in making such pictures.

In almost all snow scenes the contrast range between the highlights in the snow and the shadows in tree trunks and rocks is great, and we must therefore be extremely careful with our exposures. Under-exposure will make the dark objects come out as black holes in our print, without any detail and with an unpleasant emptiness. Over-exposure, on the other hand, will block up the highlights in the snow and render them as blank white paper totally without interest and almost unpleasant to look at. The right exposure, however, will result in enough detail throughout the entire picture area, and we must make our meter readings accurately, or use our exposure tables and calculators carefully. If the subject matter warrants the use of a little more film, it will be better for us to make additional exposures with different times in order to be sure that we have caught exactly the effect that will make the best picture. Our lighting, too, is tremendously important and snow scenes made with the light behind the camera are almost never worth while. Working against the light leads to dramatic effects and brings out all the glisten and sheen and surface texture of the snow itself, but in these pictures we must be sure that the sun does not strike our lens. A sunshade is imperative, too, for nearby drifts or snow-covered banks will reflect light to our lens and keep us from getting the crisp negatives that make these pictures so effective.

When we are trying to bring out animal or bird tracks in the snow, it is vital that we utilize a slanting light to throw shadows into the tracks and thus make them stand out more clearly. As a general rule, we need to stop down the lens considerably in order to make all the details in our picture perfectly sharp, but in snow-covered landscapes we can still use the wider aperture that works so well for summer-time landscapes in helping us to push the distant part of our picture farther back. A medium-yellow filter often results in a bettered quality of snow texture, and, of course, brings out whatever clouds may be in the sky. We must remember, too, that while these pictures are principally studies in black and white, yet they make most excellent subjects for color photography and some of the most attractive color shots we have seen are of the seemingly-monochromatic snow scenes.

The indoor wintertime pictures are no harder to do but put a rather greater premium on technical skill since their subject matter is usually less exciting. An aquarium of fish or underwater pictures of marine plants can well be photographed with the ordinary camera and photoflood bulbs. Our first care in making these pictures is to avoid any reflection of the camera in the glass of the aquarium and this is best done by using some sort of black background behind the camera and keeping our lights from striking either camera or lens. The most effective lighting is of course from the side or the back, and we can often get a dramatic effect by having a low light behind the aquarium and a much smaller light to one side and a little bit in front of the glass to give detail to everything in the picture. The December Camera Trails gave some help on the use of the smaller folding camera for this purpose.

Usually if the lights are set up and turned on some time before the exposure is to be made the fish become accustomed to the glare and resume their normal activity, but we must be careful with tropical fish to keep our lights far enough away to avoid raising the temperature of the water. Two #1 photoflood bulbs in reflectors 4′ from our subject will enable us to use an exposure of 1/25 second at f/11 with the fastest pan films, and this should be a short enough exposure to enable us to stop any motion of the fish if we choose the right moment for making our exposure.

Color pictures of the same objects are complicated by the filter effect of the glass and the water, and each different set of circumstances requires a little experimentation to show us exactly the technique needed. In a recent case where the glass had a slightly bluish tint we found that the use of the regular daylight Kodachrome instead of the type B, which is used in artificial light, worked with

this filter effect to make the necessary corrections and give natural results. This was learned when a board painted in various colors was placed in the tank and inspection of the resulting transparencies showed that all the colors were too reddish with the type B film. This is perhaps too complicated for most of us, but any such subject is always worth a trial at least and we shall find very often that we can attain most pleasing results without very much experimental work.

The most important things to be considered in the photography of plants and flowers are the background and the lighting effect. A sidelighting, such as will be used in making a portrait of a flower with a strong light above and well to one side of the blossom, supplemented by a reflector on the other side or a second light near the camera, works well. The background should be as plain as possible, and a dark gray cloth is preferable for almost any picture of this kind. Above all, we must avoid having anything in the background that will detract from our principal object.

This is offered simply as a hint. Too often we are tempted to store our cameras with our flannel trousers and take them out only when Spring approaches, but when we do this we are missing some of our finest opportunities for good pictures.

Hints for the Contest

In talking with Dr. Anthony, one of our judges, about the pictures which have been entered thus far in our contest it was surprising to find that his angle on the picture question agreed so closely with that of Mr. Lootens and the writer.

Since he is the Curator of Mammals in the American Museum of Natural History, we would rather expect him to see pictures from the naturalistic standpoint. And so he does. But he lays as much emphasis on photographic excellence and print quality as would any photographer who chose to consider himself a pictorialist.

Said Dr. Anthony: "A familiar subject, when well done, is far more interesting and valuable than the strange and unfamiliar handled less well. A picture to be successful to the critical observer must be an artistic achievement rather than a mere record of something unusual. Subject selection is of course important, but the prime requisite for pictures entered in a contest such as this of Camera Trails is photographic excellence. The unusual viewpoint, original lighting, and good photographic technique do far more to make a picture attractive than can the subject matter alone. Naturally, if we can combine unique subject material with good composition and real print quality, we have an even more striking picture, but if we must choose between a mediocre photograph of the strange subject and a really excellent picture of something more familiar, there can be but one choice, the good picture".

Had this opinion come from Mr. Lootens, who is preeminent as a pictorialist, it would have been less surprising and less forceful since we would naturally expect him to take that attitude. When it comes from a man of Dr. Anthony's experience and standing we, as Nature photographers, can only agree that hereafter we will lay more emphasis on our photographic skill and technique, and when we have perfected these two, then seek out the more unusual subject. We hope this will be a valuable hint to future entrants.

The February Contest

The winners of the February Contest are E. Fred Miller, St. Louis, Missouri, and Victor B. Scheffer, University of Washington. Their pictures are of outstanding excellence, and we most heartily congratulate the winners for the care and diligence with which they have sought out their subjects and for the perfection of their photographic technique. We only hope that unavoidable losses in reproduction will not lessen too much the real value of these pictures as they appear on opposite page.

These winners have received their choice from the following books: *Photo-Lab-Index,* by Henry M. Lester; *Nature Photography Around the Year,* by Percy A. Morris; *New Ways in Photography,* by Jacob Deschin; *The Fun of Photography,* by Mario and Mabel Scacheri; *Photography,* by Dr. C. E. K. Mees; *Finding New Subjects for Your Camera,* by Jacob Deschin.

The runners-up in the Contest were Mr. A. Haak of Norwood, Manitoba, who was one of the winners in the January Contest; Mr. Clarence R. Quick, of Berkeley, California; Mr. Bert Huntoon, Bellingham, Wisconsin; Mr. Victor B. Scheffer, who also is one of this month's prize winners.

As a whole, the pictures submitted this month are splendid and are much superior to the usual run of contest entries. We feel that every entrant is to be congratulated for the work he has submitted. Remember that you need no entry blanks and that your print may be of any size, up to 8" x 10", printed on any kind of paper. To enter the contest, simply mail your print with your name and address on the back of each to Norris W. Harkness, 320 E. 42nd Street, New York City. The sooner you mail them and the more you send, the better your chance of winning one of the above-mentioned books and a crack at the $25 merchandise prize from Willoughby's, Inc., which will be given to the final winner at the end of the year.

Photography on the Air

As most of the readers of this department probably know, there is a radio program that is devoted to photography on the Blue Network of the National Broadcasting System, at 10:30, E.S.T., each Wednesday evening, under the leadership of Herbert C. Mackay, F.R.P.S., who is one of the finest workers and most independent thinkers in the entire photographic field. The program, known as "Adventures in Photography", takes up various photographic problems and allows us to hear the voices and opinions of some of the best-known photographers and writers on such subjects.

The event of greatest interest to Camera Trails readers will take place on the second or third Wednesday evening—at this moment it has not been definitely decided which—in February, when the editor of this department will assist in a discussion of the problems of Nature photographers. The questions discussed that night will be those that you have sent in from time to time, so it is expected that the program will be of real interest to you all. It is my opinion that this program is doing a lot for the amateur photographer and I believe the readers of this department will do well to make a 10:30 date with themselves for every Wednesday evening.

(Camera Trails is continued on page 123)

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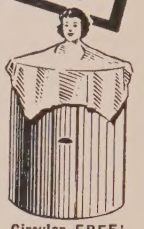

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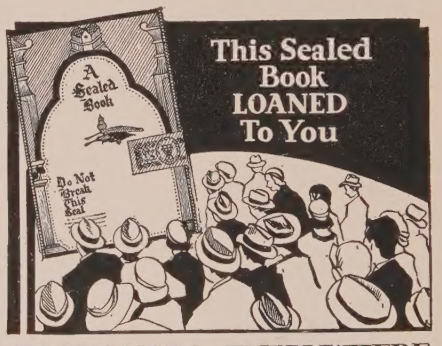

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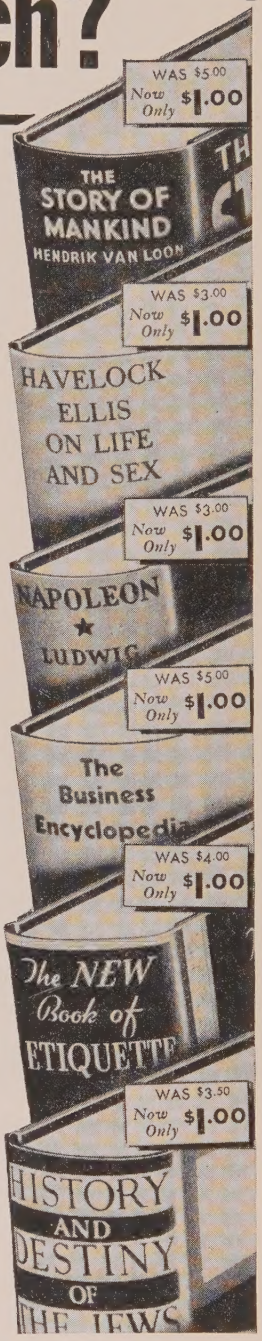
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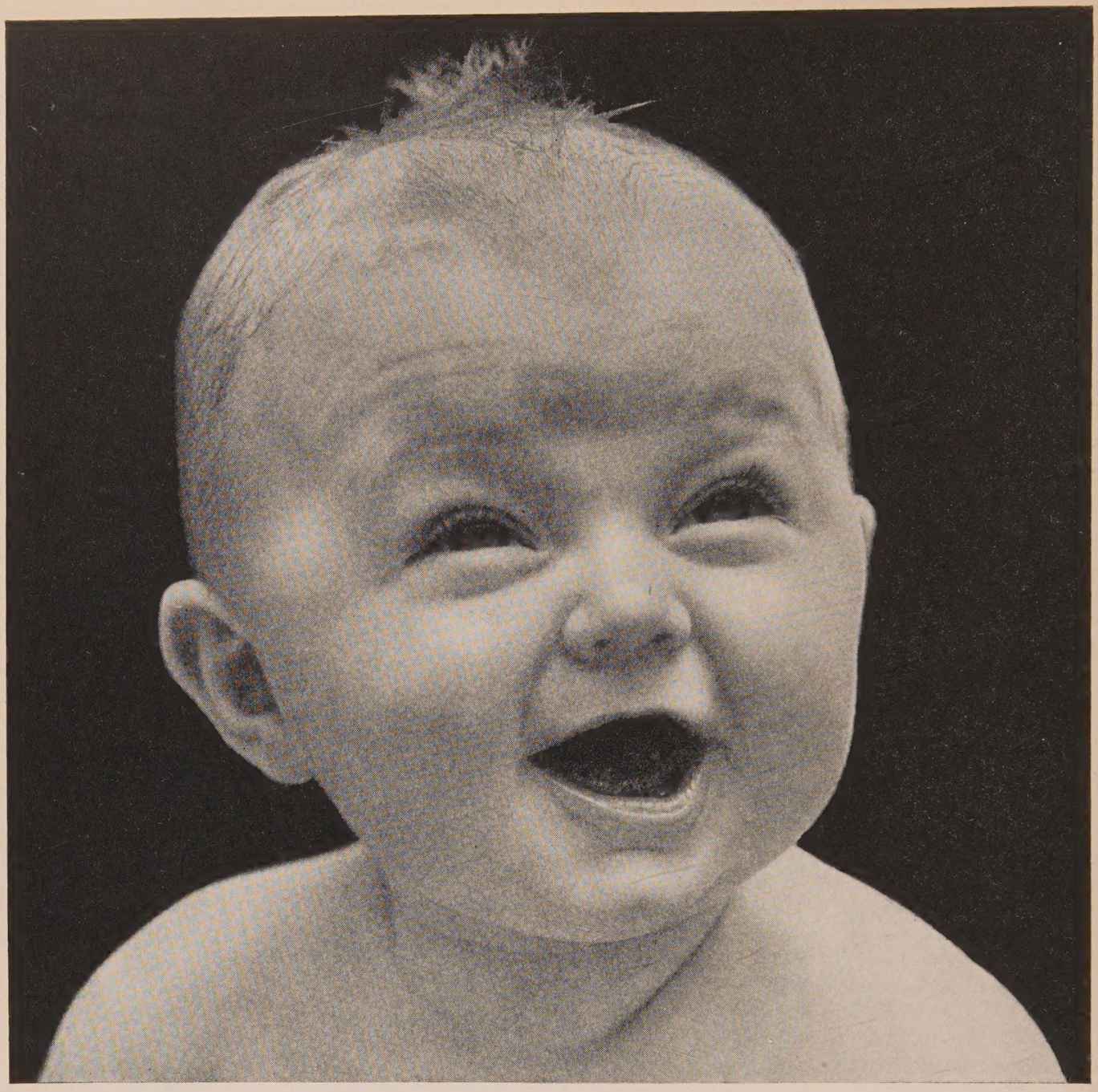

"YOU'RE TELLING ME!"

"That's a funny one. You're telling me what a great thing the telephone is. As if I didn't know!

"Why, I'm one of the main reasons there's a telephone in our house. For you can bet your life I keep the folks pretty busy around here.

"Just think! If we didn't have a telephone, we couldn't order things in a hurry from the stores. And Grandma couldn't call up to ask if I had a tooth. And Daddy couldn't talk to us when he's out of town. And Mother would be tied down just something awful.

"And suppose one of us suddenly took sick? Or there was a fire? Or a robber, maybe? Well, I don't worry about those things when I see the telephone.

"Doesn't cost much either, my Daddy says. And Mother says, 'I don't know what I'd do without it.' "

BELL TELEPHONE SYSTEM

Indoors and Out

By HOWARD ZAHNISER

"THE SANDS were running against the current winter season and February was nearly gone. We began to think about the coming of the meadowlarks. And then the wind howled in out of the northwest, the mercury slid down to five degrees above zero and snow filled the air. The next morning there was a thin carpet of it covering smoothly the floor of our woods, perfect for tracking. Here were etched the records of the comings and goings of rabbits and mice, and running from north to south nearly the whole length of this little seven acre patch of oaks, poplar, hickory, hawthorn and thick underbrush, there ran the unmistakable trail of a weasel."

That weasel trail was what Mr. Norris W. Harkness, my colleague on another page of this magazine, would call a camera trail, and as Tappan Gregory followed it it turned out to be a long, long trail, leading through and far beyond the backyard even to the timber wolf country of Louisiana and the haunts of the cougar in the Carmen Mountains of Mexico. Not only did it lead to a great many photographs of animals, but it also enticed Mr. Gregory into other outdoor places where he made many observations like that one in February.

Eyes in the Night, recently published by Thomas Y. Crowell Company ($3.50), is Mr. Gregory's description of these trails and his account of how he has photographed mammals after dark. Fifty illustrations in the book bear witness to the success of his efforts. *Eyes in the Night* is an interesting volume, and one of great value to those who wish to photograph animals at night. Furthermore, it contains a great deal of information about the habits of the mammals photographed, and this information is all the more valuable because many of these mammals are nocturnal and consequently are seldom seen by those who do not have eyes in the night.

This book comes to the market at the same time that *Hawks in the Hand* by Frank and John Craighead (already reviewed elsewhere in this magazine) is enjoying a warm reception. The Craighead twins made a specialty of climbing trees and cliffs to take pictures of hawks and owls from blinds. Tappan Gregory and his associates "trapped" their animals into touching wires that carried current to set off brilliant flashes, and trip the shutter. It is interesting to note that both books show that the authors have developed a sympathetic interest in all the creatures with which they have been dealing. Frank Craighead, for example, testifies to respect and admiration for even the Cooper's and sharp-shinned hawks. "To me they are in every way," he says, "as fine as the birds they kill, and like them they must live in the manner for which Nature has fitted them." Going to a similar extreme, Mr. Gregory speaks at some length on behalf of even the coyote. "There must," he says, "be much of hardihood in his makeup, combined with native cunning and shrewdness, . . . and it is hard not to concede, however grudgingly, a small spot of admiration for his adaptability which enables him to maintain himself not only in the unspoiled wilderness but also on the fringes of civilization." I think it is safe to make the deduction that outdoor photography as a sport leads to a wide ranging sympathy with wild creatures.

This observation increases one's interest in the sport of these photographers and in the popularity of their books. There are a great many conservationists who are more interested in photography as a substitute for shooting with a gun than they are in the resulting pictures, and to them *Eyes in the Night* will seem to be a good book in advancing this "cause." Numerous ways have been suggested for promoting photography in lieu of shooting. I once heard one man express the opinion that if a camera were mounted on a stock like a gun's and had the shutter synchronized with a percussion cap there would be little difficulty in getting sportsmen to abandon killing. It is my opinion, however, that the examples of men like Tappan Gregory and boys like the Craighead twins will do much more to popularize wildlife photography, especially among the young people. There are many sportsmen, of course, who will never abandon their guns for cameras. For these, hunting is one rare part of their enjoyment in the outdoors for which they most assuredly do not wish a substitute, and there seems to be little advantage to be gained in teasing them with the suggestion. At the same time there is an increasing number of sportsmen who are using cameras for at least a part of their outings. Furthermore, it seems likely that in the future many who never have hunted will resort first to the camera, and if their interest approaches that of Mr. Gregory it is not likely that they will find much time for another sport; unless, indeed, the frequently threatened increase of leisure actually comes about, and a man has more than two weeks or a month each year for recreation. The stringent hunting regulations that have become necessary with increasing numbers of hunters, and which are probably here to stay, may also encourage many sportsmen to carry cameras to their camps for use when they are satisfied with shooting.

Mr. Gregory himself marvels at the enthusiasm that has been his in following his photographic hobby for thirty-five years, and he thinks that there may have been an element of pure chance in the fact that he came to prefer the camera to the gun. The beauty and interest of his nighttime photographs as reproduced in *Eyes in the Night* are certainly adequate to justify to anyone his decision to adopt the camera, and he is explicit in describing the advantages of his choice of camera over gun.

"It leads," he says, "to a type of pursuit that knows no closed season, no bag limit, no forbidden ground. The objectives of such a chase are limitless, the lawful prey of the huntsman infinite in number. All wild animals, however great or small, are legitimate game. For, to the eye of the camera, a mouse at a distance of two feet is as much big game as a moose at twenty feet. I must confess that the satisfaction of securing good pictures of some of the rodents and fur-bearers in my own backyard has almost equaled that derived from the successful pursuit of moose or timber wolves or mountain lions in out of the way spots of unspoiled wilderness."

" . . . GINGERLY, SKILLFULLY, HE EASED THIS STRUGGLING CREATURE INTO IT AND SLAMMED THE LID."

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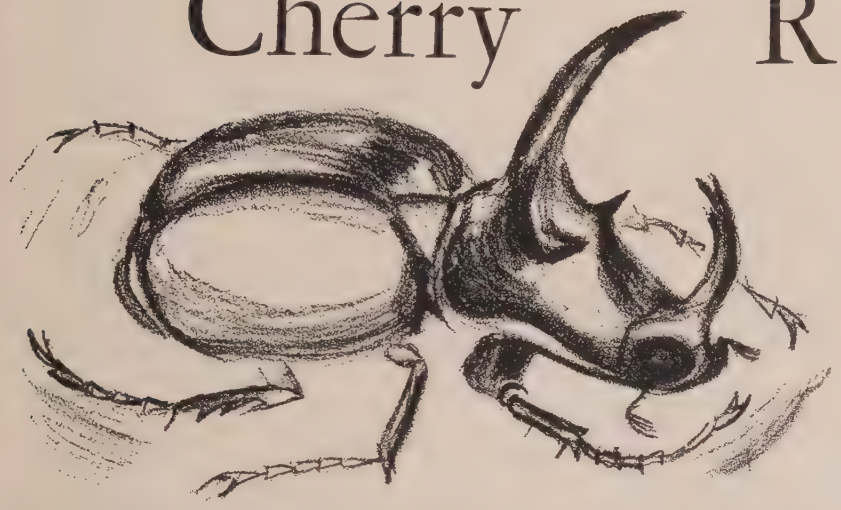
Cherry Rhino



ALTHOUGH THIS DRAWING IS OF CHERRY RHINO AS THE AUTHOR RECALLS IT, NO KNOWN INDIAN SPECIES CORRESPONDS EXACTLY TO THIS RENDERING. IT GIVES A GENERAL IDEA OF THIS BEETLE, HOWEVER. BELOW, THE LOCALE OF THIS STORY

Although the Little Dane did not find one, a sawtooth made him king of the beetle season

By MARGARET NEWTON

Illustrated by R. Bruce Horsfall and the Author

THE Little Dane was a boy not given to talking of unsubstantial things, in a country where men, as they grow older, spend long hours spinning tales of the eerie half-dark on the edges of forgotten worlds. Nor would he have acknowledged the strange language of the monsoons, which already in his youth had laid strong hold on him. Rather, he would have laughed.

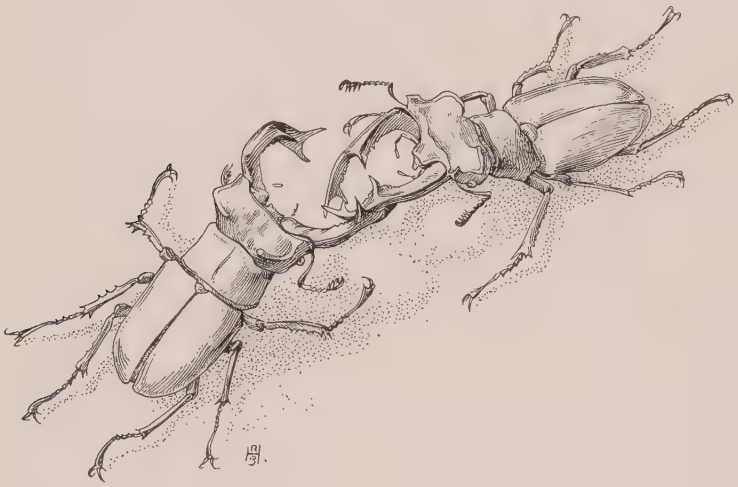
Nevertheless, this is a story of the Little Dane and the monsoons, those lusty winds that sweep up from the southwest ocean, across coastline and desert and the fertile plains of India to keep their tryst with the Himalayas, those far-northern ranges toward Tibet. For weeks they hold the brooding mountains in thrall, shutting them off from the steaming valleys with a curtain of white mist. Sometimes they fall to battering them mightily, pulling rocks from their places with merciless torrents; sometimes they lose their fierce gustiness by the time they cross the foothills, and the mist creeps up the mountain like a white enchantress. From the hidden depths of the waiting earth it draws out treasure; as surely as a snake charmer lures a cobra into the open with his fluting, it calls out swiftly an emerald fringe of ferns upon dark tree limbs. Then let the barefooted coolie watch where he puts his foot on the quickened earth, and the dreamer take care that he crush no frail and lovely thing, or incur the anger of something vengeful the monsoon's rain has wrought.

But if the Little Dane was a dreamer, no one knew it. While the small girls in Long Dorm whispered gleefully about him after "Lights out," and the big boys thought of new ways to bait him, no one would have called him anything but the Little Dane, dauntless strutter in school brawls, daredevil replica of his dread ancestors who had harried King Alfred of the Island Kingdom they knew so well from history. In the little American school in the Himalayas, the teacher was the only one who had

occasion to use his real name, which was a distinguished one.

Surely there was nothing dreamlike about him this evening in the dim seventh standard classroom. Hands clenched by his sides, he was watching intently a group of the big fellows who had stayed after school, and were gathered around a desk. It was a beetle-fight they were staging, with two three-inch stags someone had brought in that morning. This was the time of year the monsoons brought the lumbering creatures from their hiding underground, to stumble clumsily about the hillside in their new shells, to zoom in helpless rapture around and around the night lights, until they fell prey to sharp-eyed bird or boy.

All schools are subject to the rule of fashion, and this small one, however far, was no exception. Each season had its sport. Marbles, horse chestnuts, hockey, and beetles followed each other according to their respective weathers.



"IT WAS A BEETLE FIGHT THEY WERE STAGING WITH TWO THREE-INCH STAGS. . . ."

It was always the weather that changed things. Here, where it had been sunny and dry, icy, or scorching hot, it was now warmly damp and lush with a sense of growth in all things, and a feeling of isolation in the mountains that made the good regard of one's fellow schoolmates doubly important. This was the beetle season, and no one was more ardent in the hunt than the Little Dane.

Finding the beetles was one thing; fighting them was quite another, and soon he was a bit sick at the sight of a black-armored leg snapped off by angry mandibles, and the strange uneasiness of being with these humans overtook him. Even with their polyglot slang, their varied nationalities—English, American, Indian—he knew that he did not fit the pattern. In the whole school his accent stood out, different from anyone else's. But the fighting had helped; it had made him feel more like one of them. His thoughts droned on, mingling with his eagerness to hear them.

"Yeah, no one's found one yet."

"I say, don't they have just one on the hill every year, or something like that?"

"Yes, and the guy that finds it's the pukka champ for the season!"

"I say, Clark, let's all go around the chukkar* tonight! This is just the part of the rains they turn up. We may have some luck, and no one's found even a decent bamboo beetle for ages."

There—they'd spotted him now!

"Scram, you! Chuts** aren't allowed in here—and mind you keep your gob shut about tonight!"

He left with dignity, in a silence so unusual for him that it seemed almost meek; walked through the hall, across the quad, and took the little footpath up the hill. He dragged a sleepy rhino out of one pocket, and, more carefully, a stag from the other. With experimental cruelty he jammed their armored fronts together, but once their fighting anger was stirred, it sickened him, and soon they were back in their respective pockets. He found himself half-way up the mile-long road to the top of the hill. He stopped to rest.

It was unusually clear, and the slanting rays of the westing sun were still bright enough so that he could see far over the broad valley, the range of foothills beyond, and the still farther plains. It made the world so big. Looking at the silvery streaks of rivers, his eye traced them across the valley until they were lost in the blue chain of the Siwaliks, only to catch the glint once more on the plain beyond. Then his fancy was held by the squares of fields and cities. They were not very red or brown, or green even; rather they were vague, interesting colors he could not name. Rivers, cities, fields; his eye swept far to the east and west. Everything below was so wide, and the mountain on which he stood, so tall. It was almost terrifying. For a while he had lost all sense of himself. Now he felt lonely and very small. Already it was not so easy to see the minute squares in the valley. The sun was lower. His eye caught a wisp of filmy white at the foot of the mountain and his heart took a strange lightness. He turned, relieved, and hurried up the path. This is the best time of year, he thought exultantly, as the strand of mist brought a feeling of reassurance he could not explain. He stopped at another turn of the zigzag road to look down on it again. Swiftly his mind's eye hastened the process of the mist's arising; envisioned it climbing, wave upon wave, until it clung to the whole hillside and shut out even the sun. It was like the djinn in Solomon's jar—beginning with a slender thread of smoke and growing to be a monster of power. A familiar thrill of expectancy brushed him. He knew why it was. When the cool whiteness was in front of you, and all around you, you never knew what would appear from it.

What would appear from it—the Cherry Rhino! As he hurried to finish the way home he remembered suddenly about the beetle hunt around the chukkar and what it meant. The Cherry Rhino! So that was what they were after! For weeks he had been half thinking about it, but now he was somehow amazingly sure he would find it. He could almost feel it in his hand, its bigness, the tickling

*A road circling the mountain.
**Youngsters, "small fry."

of its protesting legs; he could almost see the mahogany sheen on its wing cases and its four darker horns. The black three-horned rhino in his pocket felt so small. Everyone found two or three a season.

The monsoons were at their height. For days Clark, the school's champion beetle man, had been walking about in a trance, eyes heavy from sleepless hours of watching the lantern light, ears sensitive from straining for the loudest drone of insect wings. It was not until most of the school was aware of the Little Dane's evil temper that he remarked it.

"I say, the Dane's getting hang cheeky lately."

"Yah, I wonder what's gotten into him. He's been in an awful peck over something or other. Did you see him the other day? Hari Lal was eating an apple, and the Dane jumps and grabs it right out of his hand. . . ."

"He's got plenty of brass for such a little chap. All the chuts in his class are heckish funked of him."

"And he doesn't bully them; that's the funny part of it. He always picks on the big guys, and half the time they're so surprised they don't do a thing."

"Hey, Clark, no one's found the Cherry Rhino yet, have they?"

"Naw!"

"MAN! A SAWTOOTH! THEY HAVEN'T FOUND ONE OF THESE FOR FIVE YEARS."

"Then what say about going around the chukkar again tonight?"

But the Little Dane, swaggering boldly past the school building, was feeling all the half guilty delight of him who plays hooky. Before he had gone far down the rugged shortcut to the valley, the urgency of his purpose sobered him and made him scramble on, helter skelter, starting a shower of stones rattling. For two weeks now the quest of the Cherry Rhino had sent him in every spare moment to scan the nearest part of the hillside, to walk the chukkar night after night when the street lamps, enticing beacons glimmering through raindrops, drew all the beetles in Landour. There was still one possible hunting ground, and he could not wait until Saturday's half holiday to try it.

Reaching the winding white road to the Dhobi Ghat—the washermen's village—the boy took it for a while until he found a suitable path to the foot of the slope. A few minutes and he was in the valley, a narrow defile, the point of the V made by the two mountainsides. The heavy morning mist hung low here, full of promise—once vague, now seeming to tremble on the tangible. He followed a dark stream until it reached a small flat, and it was not long before he was on a dim footpath up the other mountain, stopping now and then to push aside a bush or tree limb.

Witch's Hill! There were no people living on the mountain because some hidden store of iron drew all the summer lightning to it. Even the charcoal burners shunned it and left its sides covered with heavy forest. There were barking deer here, he knew, and jungle fowl; but this morning all that spoke were a flock of darting strawberry finches. The silence of the mountain and the mystery of the veiling haze that stole upward made him conscious of the pulse in his throat and ears as his wide, swift eyes combed the grassy strip before him, the richness of the jungle foliage beside it. He stopped a moment to tickle a shambling, lackadaisical scorpion with a twig. It amused him to see it stiffen instantly into military alertness, claws outspread and dagger poised over its back, but the choking silence about him gave no room for laughter. Still he searched, behind his eyes an image of something large as a goose's egg, and almost as round, something with fantastic horns and a back the color of rosewood stain. Nothing yet, but it waited around every turn of the rain-soft path.

The path drew him strongly on, until the midday sight of some wild strawberries brought him to a halt with sudden hunger. His warm lunch at school! How far the morning's excitement had carried him! Discouragement tightened his throat as he turned furiously to run downhill; and it was not until he reached the familiar flat by the stream that his old sureness began to return with its teasing promise. Then the rain broke. No light shower, this, but the torrential monsoon.

It was still drenching three hours later. The group who had stayed after school in the dim seventh standard classroom was too intent on something at the table to pay any heed to the rather wild-looking small figure who had just appeared in the dreary doorway. Without knowing what he was doing, drawn by some strong premonition, the Little Dane came closer to peer over Lal's shoulder. He saw, almost without surprise, struggling in Clark's outstretched hand—something large as a goose's egg, burnished darkly red.

"Hey, you!" Lal had felt his presence and turned around. "No little guys . . .," but he grinned as he said it, remembering the incident of the apple. The Dane felt truculent, in no mood to see a grin. Clark, and not he, had found the Cherry Rhino. For such he was holding.

"Who says I'm a little guy?" His fist shot out. A fight might help to ease his feelings.

Clark stopped it, taking note of his wet clothes.

"Where have you been, fella—playing hooky?"

A wave of understanding went around the ring. Scarcely any change in facial expression, but he felt somehow it was not looked down upon.

"My gosh, look at your legs!"

For the first time the Little Dane was conscious of the aching weariness of them and of the red trickling from sundry scratches left by angry bushes.

"Oh, yeah!" He turned to go. Someone saw a leech on his leg.

"Hey, let's see how many you got!"

Lingering, he pulled off shoes and stockings. Leeches were clinging in half a dozen places, some of them firmly anchored, not to be pulled off. Lal took a small bundle of salt from his pocket and put a few grains on each. The Little Dane watched them writhe, finding it somehow pleasing to see the hateful things suffer; steeling himself to admire the beetle again.

They could not stay long away from it, all wandering back to Clark to revel once more in its fine points, the sheen and rich color of it, the long, sharp horns that gave it a deceptive appearance of fierceness. Soon the incredible machinery of its armor-plated motion held him, too. The perfection of each miniature piece and casing, the smooth working of each joint, the mystery of the dull-witted creature within its hard shell. What did it think; feel? He was one of the last to leave, to grope a dusky way home through the drizzle.

Full of dreams, he almost stumbled over something big and crawling before really seeing it. Alert now, suddenly very practical, he must be swift and quiet. He felt for the tin can he had been carrying all day for just such an emergency; gingerly, skillfully, he eased the struggling creature into it and slammed the lid. For him now the the fog was the color of opal and the rough trail a smooth highway.

Came morning. Clutching a tin loud with the scratching protests of its prisoner, the Little Dane burst upon a group in the seventh standard classroom.

"I say, Clark, I've got something to show you!"

Clark took the can. "Sounds like a big one."

"It is! Hey, care how you open it. Then tell me what it is."

Clark slowly took off the lid. There emerged a dark gray monster. Three inches long; mandibles, toothed and strong as iron; long sturdy legs that made a frantic effort to help it escape, it was concentrated fierceness and spite.

Clark caught it expertly just behind the thorax. His voice held wonder. "Man! A sawtooth! They haven't found one of these for five years!"

Five years! The Little Dane stared out the window and said it over and over to himself. When would this class end? It seemed to his dazzled brain that the mist and rain outside were pearly, fluctuating with some dim happiness kin to his. So this was what the monsoons had promised one evening at sunset! As his thoughts cooled, however, the feeling vanished. The rain was as inscrutable, as brooding as always. How excited all the fellows had been! A gray day. Tomorrow it might be clear. And chestnut season would be starting in the Himalayas.

•

A Lantern for a Nest

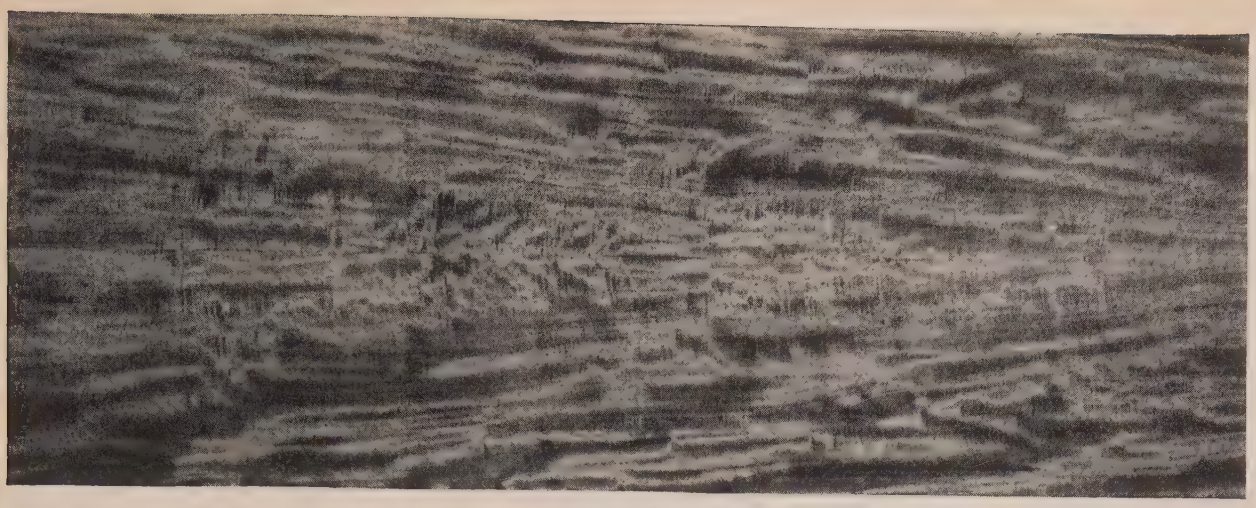
Phoebe chooses odd site for home

By GRACE WHEAT

•

THERE seems to be no end to the adaptation of birds to man's environment when the nesting season is on. Song and insectivorous birds that seem to enjoy raising their families around human habitations often appear to have a sense of humor in selecting nesting places.

One pair of phoebes, out looking for a likely spot for a home, found this old lantern hanging from a nail on a dark and sheltered back porch. Its top looked most inviting, so mud and moss were diligently brought to build the foundation for the nest. It was then carefully lined with soft hairs as a resting place for the three pearly-white eggs that the mother laid. This, of course, put the lantern entirely out of commission for the duration of the nesting season. It was simple, however, to lift the nest-bedecked lantern from its nail and carry both out into the sunlight for a photographic record. The parent birds were none too complacent about the maneuver, but it was quickly over and the home was returned to the porch without mishap. Ignoring the brief interruption, the birds went right back to the job of rearing their small family.



MAHOGANY—TIMBER DE LUXE

Queen of wood is a true member of forest royalty

By HENRICKS HODGE

Photographs courtesy of the Mahogany Association.

THE GRAIN OF MAHOGANY IS SAID TO HAVE INTERESTED QUEEN ELIZABETH OF ENGLAND

Above, a strip of Honduras mahogany manufactured for veneer. At left, a large specimen of *Swietenia macrophylla* being felled in the jungle of Central America

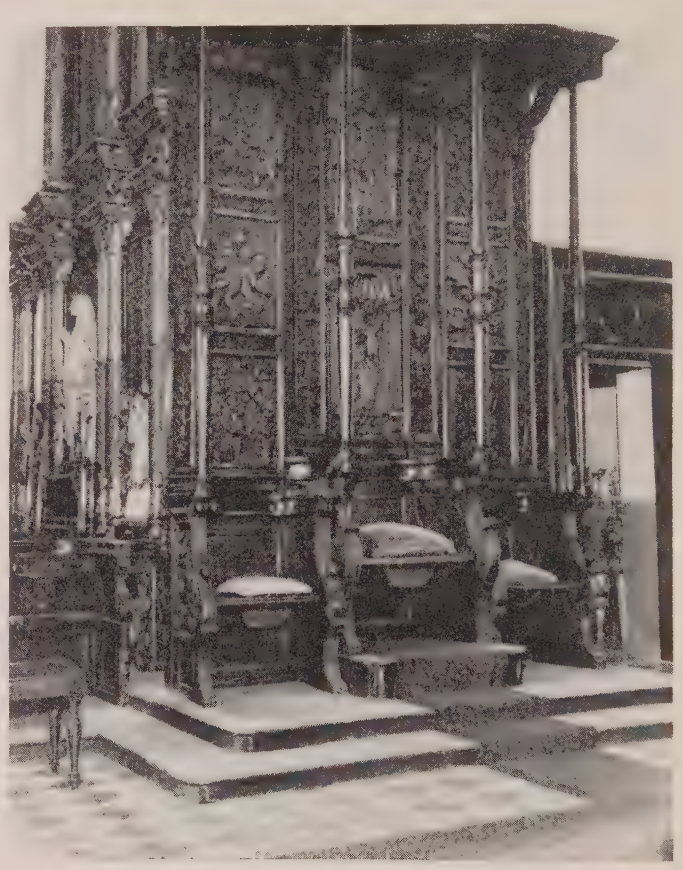
TO THE early explorers the West Indian islands must have been a disappointment. After traversing a treacherous ocean they found that the spices they sought were few and strange, and gold and silver were lacking. Dreams of quick riches vanished. The explorers gazed upon dense forests inhabited by a cannibal race. But in those forests, unknown to the adventurers, there was gold of a sort. It was a growing green gold, a tree whose wood, properly seasoned, took on a rich golden color—mahogany!

It was natural for this valuable tree to be at first overlooked, for it grew in inaccessible jungle forests where tree species were legion. By 1600, however, this wood had made its debut in Europe. In an era of wooden ships, poor charts and strange seas, wrecks or damage to vessels were frequent, requiring repair in foreign harbors. Some of these early repairs were made with this strange, red wood, which thus found its first use by civilized man. Cortez, building ships for new voyages of discovery, must have noted with favor the great buoyancy, strength and durability of the timber from this giant of the West Indian forests. Thus, in these early days, mahogany began a long career of association with the sea, and even today a major use of this wood is in the construction of fine pleasure craft. The qualities and possibilities of this timber did not long escape the eyes of far-distant continental shipbuilders and merchants, and soon the galleons sailing from the New World were listed as carrying not only the wealth of the subdued Aztec and Inca civilizations, but, also, one of the riches of the forests—mahogany.

The first big job of a sixteenth century assembly line was soon turned out in solid mahogany in the form of a fleet of vessels fit for a king—Philip II of Spain. This was the Spanish Armada. Sunk off Britain, these hulks of transformed jungle gold represented the earliest approach of mahogany to English soil. Finally Sir Walter Raleigh, returning home from Trinidad in 1595,

guided his vessel with a brand-new rudder of Spanish mahogany. The story is that his Queen, admiring the golden color and beautiful grain of this unusual wood, was soon presented with a table fashioned from the timber by the ship's carpenter, and at Raleigh's request. If the tale is true that long-lost table was the pioneer of all mahogany furniture, representing as it does the first use of this queen of all cabinet woods. At first employed sparingly because of the difficulty of working its hard grain, the wood was finally conquered. In time, during the eighteenth and nineteenth centuries, it reached the peak of its popularity in the unsurpassed masterpieces of furniture that have been left us by the great Georgian craftsmen. Since those days not a single substitute has been found for the well-balanced qualities of true mahogany.

Nearly anyone can recognize mahogany in the dining room, but few have had the privilege of seeing the living forest giant that supplies the world with this colorful timber. The mahogany tree is just as stately and beautiful when growing in Nature as is its wood when fashioned into furniture. Indeed, if it did not demand definite requirements as to atmospheric conditions and growth sites, this tree might well be used as an ornamental to grace tropical gardens with its lush, evergreen foliage.



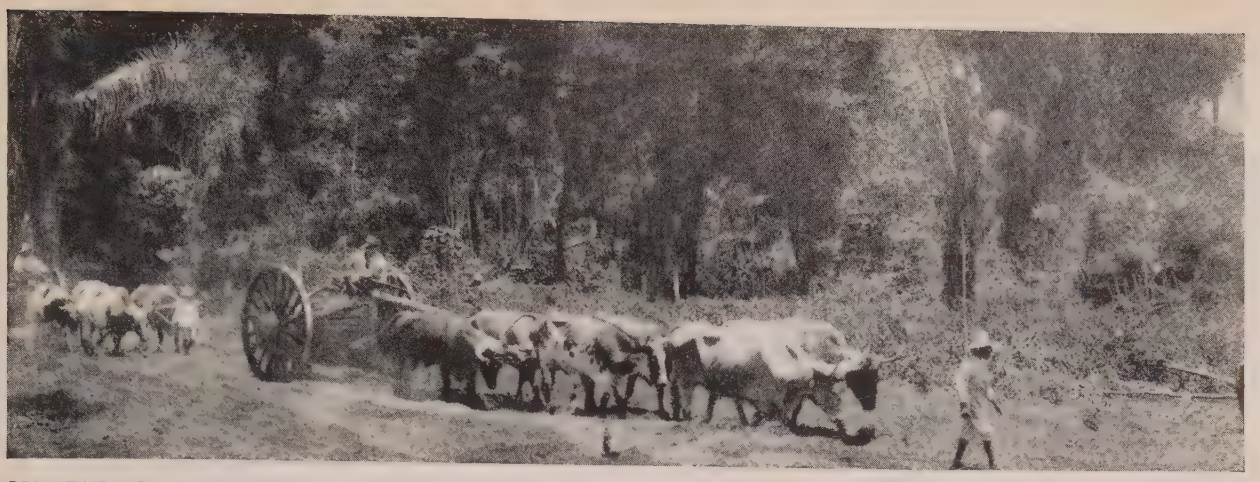
POSSIBLY THE OLDEST MAHOGANY WOODWORK IN THE WORLD
This is the Bishop's throne set in the chancel in the cathedral at Santo Domingo. It is about four hundred years old and still perfect, a tribute to mahogany

Typically, the species of *Swietenia* inhabit the dense, wet, upland forests so characteristic of the tropical lands bordering upon the Caribbean Sea. In such locations it is not unusual to see specimens lifting their straight, symmetrical boles upwards of one hundred and fifty feet—or well over the height of a fifteen-story building. Such jungle pillars require ample bracing, and so large mahogany trees, like continental cathedrals, often brace themselves against the lateral thrust of so much aerial superstructure by the formation from the main trunk, at ground level, of heavy "flying" buttresses, arising through the development of lateral roots. Atop each of these living shafts of potential red gold, trunks free of all branches for from forty to sixty feet, is an umbrella-like crown of deep green foliage. Leaves of *Swietenia* are compound and most closely resemble the similarly compounded leaves of our native ash, butternut, sumac, or hickory. Like many of our own forest trees the flower of the mahogany is unimpressive. When the tree is in bloom, however, the buff color of the paniculate-clustered flowers makes possible its discovery from the air or from a height. Later in the season appear chestnut-colored fruits that mature tiny winged seeds, used once by the ancient Aztecs to mix with oil for a cosmetic.

There is no such thing as a mahogany forest. Accustomed as we are to pure, or relatively pure, stands of pine, spruce, oak or maple, it is hard to realize that a good stand of mahogany means an average of two trees per acre! More often specimens are even more widely scattered in their native haunts. Logging operations are thus necessarily difficult. An individual tree must often be snaked through miles of trackless jungle. Centuries of demand for this queen of all woods long ago snuffed out all easily available specimens, once found growing close to the larger rivers, which are avenues of transport for forest products everywhere. Depletion of the better original sources, combined with difficulty of hauling out the remaining supply, makes the timber expensive, and invites the substitution of inferior woods for true mahogany.

Furniture racketeers have long taken advantage of the innocent public by palming off all sorts of woods that either physically resemble the real thing, or can, with the aid of a helpful stain as "makeup", be made to mimic mahogany's golden luster. Other tropical woods play leading rôles in this game of make-believe. Chief among these are the so-called African mahogany, *Khaya senegalensis;* East Indian mahogany, or tanguile, *Shorea polysperma;* Spanish cedar, *Cedrela odorata;* and tropical American crabwood, *Carapa guianensis.* Even the soft wood of our own temperate red or sweet gum, *Liquidambar styraciflua,* has been found, stained, passing on the market as true mahogany.

Real mahogany is "All-American"; hence timber purporting to be such, and coming from any other part of the world, cannot be the real thing. Furthermore, only one genus of trees in the new world can truly be called mahogany. Botanically this group of closely-related species is



PRIMITIVE METHODS OF TRANSPORTATION ARE USED TO BRING OUT MAHOGANY

Where a river is not available to float the logs—for mahogany is notably buoyant in water—oxen and high wheels must be used, as in this Mexican forest

known as *Swietenia,* in honor of an early Leyden botanist and physician, Baron von Swieten. The bulk of the supply comes from two principal timber species. Raleigh's historic rudder was fashioned from the first known of these—West Indian or Spanish mahogany, *Swietenia mahogani,* limited to the islands of the Caribbean. The finest comes from the Negro republic of Santo Domingo. Most real antiques of mahogany are products of the highly-figured, richly-colored wood of this insular species, but since its exploitation is centuries old, and because proper forestry practice has never been used in its conservation, the supply is now extremely limited. This fact has shifted to another species the honor of being the timber source of modern mahogany creations.

With the transfer of trade from the West Indies to the main American continent a second species of mahogany was discovered, *Swietenia macrophylla,* the large-leaved or Honduras mahogany, with a softer and lighter-colored wood. This is a giant of the coastal forests of the Central American republics. Inaccessibility to easy logging has caused the supply to be scarcely tapped, thus making the species still abundant, and has preserved the larger trees necessary for the finest of woodwork. With only the most primitive of timber methods, Mexico can yet boast of being the world's largest producer of true mahogany, with an annual output of about twelve million board feet, more than half of which is taken by the United States.

Mahogany, although not at present at the position of popularity it once held, has been and will always be a favorite among cabinet woods. There are other woods just as beautiful in their own way. The warm

CUBAN MAHOGANY

Compare this with that on Page 77

cheeriness of maple, the dark richness of walnut, the simplicity of knotty pine, all have their allure. There are the exotic grains offered by tropical zebrawood, majagua, rosewood, satinwood, padouk, and ebony. Yet the secret of mahogany lies in the fact that it surpasses the others in important but little-advertised qualities that fine cabinet-work demands. "The wood of mahogany is the standard with which all other cabinet woods are compared," says one authority, and this is true.

Beauty first attracted attention to this prized wood. The table Sir Walter Raleigh is supposed to have presented to Queen Elizabeth gave mahogany fame because of the rare beauty of its grain and the luxury of its mottled figures. This beauty is inherent in the wood itself, and, although a cross-section from a freshly-hewn tree is whitish, the air rapidly changes the color to the familiar amber hue, a hue that can itself vary from the deeper shades of the West Indian species to the lighter colors of Central American or Honduras mahogany. Best of all, and what helps to make mahogany antiques so much sought—properly finished wood actually seems to improve in time, darkening with age.

It took more than two centuries from the time of its discovery to produce the master workers in the design of mahogany furniture. These masters include such names as Chippendale, Hepplewhite, Adam, and Sheraton. Part of this lapse of time can be charged to the difficulty of working the wood because of its hardness; only the improvement of woodworking tools by special tempering enabled the later craftsmen to produce masterpieces. These examples of the cabinet-maker's art were much reduced in weight, for mahogany's

strength—superior even to white oak—enabled the use of unbraced table and chair legs, thus initiating better, lighter, and more attractive furniture. Finally, the wood of *Swietenia* is highly resistant to shrinkage during seasoning, such a characteristic making for furniture durability. Contraction and expansion during quick atmospheric changes do not occur with mahogany products.

Beauty, hardness, strength, and resistance to shrinkage—these four golden qualities are miraculously blended together in the wood of the genus *Swietenia.* They have made, and will continue to make, mahogany not only the most valuable timber tree in tropical America, but also the premier cabinet wood of the world. Fashions and vogues may change but true worth ever prevails.

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Sanctuary

By KATHERINE STANHOPE WILLIS

The tides of anguish gather force
From hidden wells of unshed tears;
And burst against the inner doors
To crush the custody of years.

The heart rides down the angry foam
And shatters on the city's breast;
But where the cement ends in loam,
Breaks the plangent tidal's crest.

And the waves of wrath go down before
Earth's simple shrine of moss and trees;
Where violets burn in faith's quick core,
And bluets keep their pact with peace.

For steel dies here in bluets' light,
And violets wear the robe of kings;
Since gods restore the ancient might
Of manna to these gentle things;

These gentle things that feed upon
The crumbled rock, the sweetened slime,
That shrine the candles of the sun;
These hold the sanctity of time.

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Wayfaring Thoughts

By OSCAR OSTLUND

When damp wood is wheezy and smoke coagulates in the throat of a fireplace, the woodsman has "cough-syrup" to relieve the congestion. A few dry splints of the aromatic pitch pine will medicate the phlegmasia of fuel and drive a sluggish smoke up through the flue. There is a natural hypnotism of health in the surging flames of rock oak, of hickory, mixed with resinous pine. A feeling of feebleness gets no encouragement from a glowing, swirling, crackling fire in the grate.

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The draft of gravity in Nature is upward. The bobolink is carried aloft in a spiral of song. The pine tip on the mountain top attracts the warbler. And below him, through the lowly leaf mould, a future forest is constantly pushing up.

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Our stolid senses are lifted up by beautiful things—words in a poem, notes in a scherzo composition, bluets in the field.

• • •

A man who lives in a close fellowship with Nature is near to a source of faith and a wellspring of life. When the blueprints of isms and philosophies fade out, a fresh ground-plan is spread out for him on the earth. A physician prescribes for his spirit with a blend in the forest of buoyant yellow poplars, in October, mixed with robust evergreen. Congenial colors precipitate thoughts of health and predispose them, upwardly, into a more clear medium, above the murk and sediment that clings to weary minds.

• • •

A high angle of sunlight means summer. A lower angle means winter. And on our mental sphere things bloom, or wilt, according to the inclination of our thoughts.

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A swaddled mind, in Nature's clinic, can be opened with a blade of blue-eyed grass.

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The universe invites us to be amateurs of time; to love each moment and embrace what is to be.

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Against a dimness in the destiny of current affairs, Nature, by repeated exposures, brings out in sharper relief, and strengthens, the picture of reserves within.

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The restorative of a distempered spirit is perspective.

SUNSET ON THE KISSIMMEE PRAIRIE, FLORIDA

Against such a background it is a thrilling sight to see the Florida sandhill cranes come trumpeting to roost

CRANES ON A FLORIDA PRAIRIE

By ALLAN D. CRUICKSHANK

Photographs by the Author

It was evening. We stood in the heart of the wet prairie country of Florida, southeast of Istokpoga. We watched the west flame into brilliance, against which solitary cabbage palms miles away stood out in bold silhouette. Then, in long sinewy lines, the Florida sandhill cranes arrived, their sonorous trumpeting making one's entire being tingle with excitement. What queer force pulled these ten score birds to the roost each night, even at the height of the nesting season? Were all of these non-breeding birds, or had some of them left their mates to guard the eggs overnight while they responded to the urge to gather with their fellows in some time-proven protective slough?

Witnessing this dramatic spectacle left me with a desire to know more about the ways of these striking birds. The way to do so was to set up a blind near one of the nests, so early next morning I stood knee deep in the ooze in my partially camouflaged blind. Thirty feet away was the nest of a Florida sandhill crane. It was a bulky mound of tawny reeds gathered from close to the chosen spot so

A FLUFFY BALL OF VARYING SHADES OF TAN

Even at this tender age the baby sandhill crane, just emerged from the egg, hides at a warning note from an arriving parent who suspects that all is not well in the vicinity of the nest

THE PARENT CRANES CAREFULLY AND DELIBERATELY COVER THE NEST

Before departing they gathered reeds, cat-tails and blue flags under which to bury young and egg, and to leave the nest looking like nothing more than an old muskrat house

as to form a clearing for two or three yards on all sides.

An hour in this stuffy hideaway, unable to sit down or stand erect, gave me some fleeting doubts about my sanity. But any hardships were fully cancelled by the ensuing rapid succession of events. One of the young cranes, a fluffy ball of varying shades of tan, emerged from its egg. Hardly had this blessed event taken place than I spied the two adults, far out on the prairie, walking steadily but cautiously back toward my hiding place. One of the old birds came close enough to see the youngster, immediately letting out a deafening rolling call that evidently carried a message. Anyway, the newly-hatched baby bird scurried over the side of the nest and hid in a small pile of floating vegetation. Then, with meticulous care, the parent bird circled the blind attempting to peer into its darkness, which then held a tense photographer.

Evidently the crane could see nothing and had satisfied herself, for she mounted the nest, a tall stately figure, and, with a low chirping note, called the young one back to the mound. After eating part of the discarded egg shell, she carried the remainder ten feet away and buried it under the water. The click of my camera immediately recalled her alertness, and she strode back and forth, again eying the blind with keen suspicion.

In the meantime the second adult had approached. They stood close together, softly chirping, and seeming to talk the situation over. Then, much to my surprise, for I had never come across an account of this in any ornithological literature, both cranes began picking up pieces of reeds, cat-tails and blue flags, placing them over the nest and covering both egg and youngster. They went about the task deliberately, even going yards away to pick up vegetation. Every few minutes both birds would stand erect and let out their penetrating trumpeting, which can easily be heard a mile away. Finally, when both egg and young were entirely covered, and the nest looked like nothing more than an old muskrat house, the two cranes walked a short distance away, took off in their singular jerky flight, and disappeared in the distance.

Thrilled with the morning's experience, I signalled to my companions to return, took down the blind and ate a long-ignored and quite dried sandwich. By the time we had the equipment loaded on the truck and were starting back across the roadless prairie both adult cranes were striding back across the marsh to their concealed treasures.

There seem to be two possible explanations for this interesting bit of behavior. The cranes may have been attempting to conceal the young and egg in the same fashion that many grebes and ducks are known to do, or, it may have been solely a means of shielding the young and egg from the torrid Florida sun. Possibly it may have been a combination of both. Watching this interesting performance, it seemed like a distinct act of intelligence, yet the birds may have been acting only in response to an inherited urge over which they had little control. Yet, realizing that I had provided an unusual disturbance for these birds, I could not help wondering whether, under more natural circumstances, they would repeat this act.

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POINT LACE

By GRACE MADDOCK MILLER

The tide is leaving the scalloped beach;
Lacy with froth, its bright silk lies
Spread in a shelved and glistening reach
Of shining smoothness beneath gray skies.

Across foam-ruffled silkiness
Sandpipers limn a graceful note,
Weaving, where slender foot-prints press,
Embroidery on a petticoat.

Bruno Liljefors

By HOLGER LUNDBERGH

When word came from Sweden that this great wild life artist had passed away on December 18, this article was already in type. It is here published without change of tense, for Bruno Liljefors still lives on in the works he has left the world.—Editor

BRUNO LILJEFORS BEFORE ONE OF HIS CANVASES

Photographic study of the eighty-year-old master of the brush made at Upsala recently by Clara E. Sipprell

IN A marshy wood in central Sweden—a haven for moose, fox, plover, hare, and pheasant—a white-haired, muscular, keen-eyed man is moving noiselessly from tree to tree. He carries neither rifle nor camera. Nor does he carry a sketch book in which to record the sudden jump of a rabbit, the wing beats of a wild duck, the sharp-eared head of a fox cub. But whatever he sees during his lonely rambling is indelibly caught by a masterfully retentive memory, its image later to be transferred to a canvas, for which famous art galleries will bid sharply.

In such manner does Bruno Liljefors, octogenarian Swedish student of wildlife, gather suggestions and material.

Liljefors was born in the ancient university city of Upsala in 1860. He was a weak child, and had to endure the taunts of his more robust schoolmates. But this physical handicap was something that the boy early decided to overcome, and by means of self-discipline, a capacity for concentration, and a systematic training, he soon improved in health. He spent long hours in the woods, and from those days dates his love for wild animals.

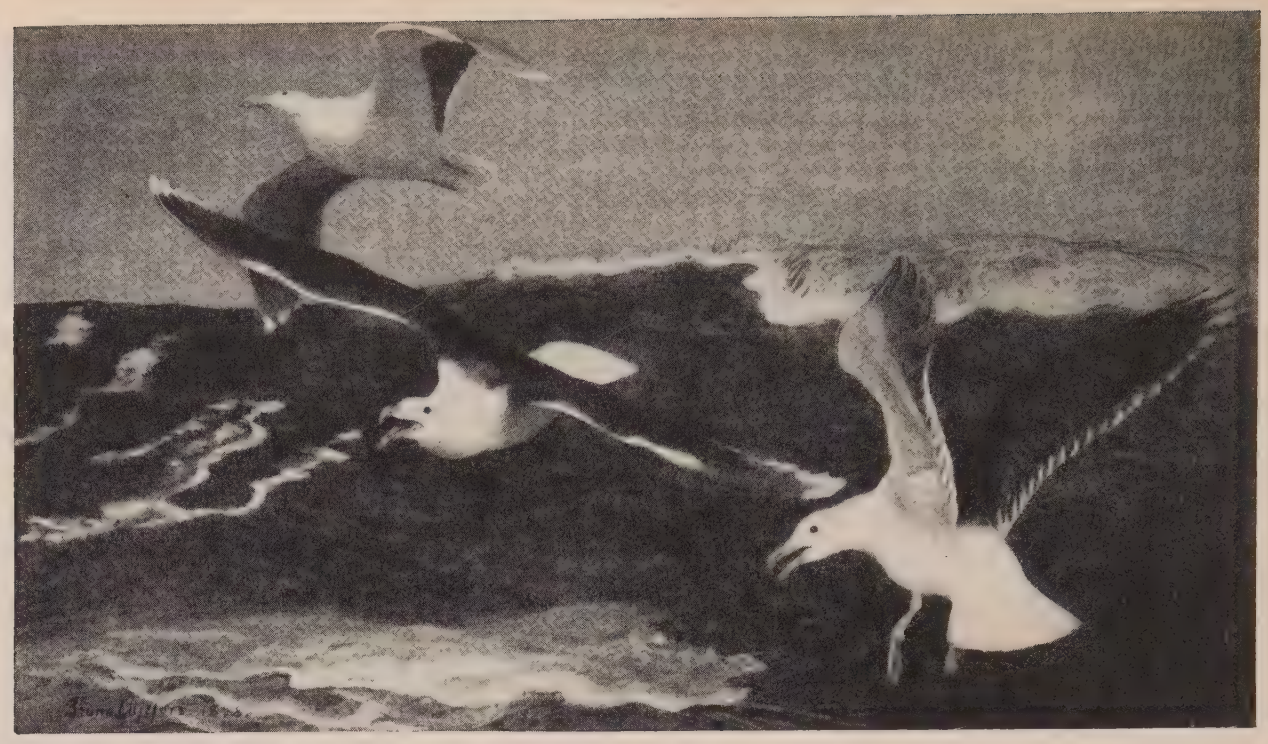
At twelve years he began to draw, and these first attempts were as much concerned with fauna as are the canvases on which he is working today. He had a trusted friend, an old taxidermist, who knew well the forest animals and their habits, and to his tales young Bruno listened eagerly. In 1879, when he was 19 years old, he became a student at the Royal Academy of Art in Stockholm, but after three years of drawing from dull and conventional plaster models, he resigned in 1882, and made his first trip abroad, visiting Germany and France.

He has since traveled extensively in foreign countries, but the greater part of his life has been spent in Sweden, and he is usually troubled by a violent homesickness whenever he finds himself far from his beloved Sweden. In this he strongly resembles two other contemporary masters, Anders Zorn, the etcher, painter, and sculptor, and Carl Larsson, the famous aquarellist, both of whom remained intensely Swedish, despite years of successful work abroad.

The woods and the open sea have attracted Liljefors equally, and for a number of years he oc-

SEA EAGLES' NEST

One of the painter's works that hangs in the National Museum in Stockholm. Reproduced by courtesy of the Swedish Travel Information Bureau



A LILJEFORS PAINTED FORTY-TWO YEARS AGO

Color reproduction only would do full justice to this beautiful oil painting of sea gulls that hangs in Sweden's National Museum. Reproduced by courtesy of the Swedish Travel Information Bureau

cupied rustic and picturesque cottages in various parts of the archipelago along Sweden's craggy eastern coast. One of these, called "The Wigwam", was located on Bullerö Island, not far from Stockholm. In these places he divided his time between the deep pine forests and the bare, stark "skerries," where thousands of wild sea birds have their abode. He recently disposed of his Bullerö estate, however, and moved to Österby Manor, near Dannemora, in the province of Upland. Here, at eighty, he is still actively at work, surrounded by his wife and some of their ten children.

One reason for Liljefors's international fame as a painter is the exquisite care he gives to composition. Each animal fits unmistakably into the frame, into the mood of the painting; the scenery, the time of day or night, the season of the year are all accurately depicted. Nobody has ever bettered him in sketching an animal in motion. One seems to hear the soft padding of paws, the sound of cloven feet, the rapid whirr of wings, the brittle splash of water as an eider flock lifts, or the crackling of branches as a heavy but agile bull moose moves through the forest.

Says Mr. Liljefors himself about this: "Their movements are measured—never showing a troubled haste even in the swiftest tempo and the most trying situation—and so logical and so well coördinated that a posture can never be ugly. Quite the opposite, each series of movements is so many beautiful surprises for the spectator. The quicker his eye, the more he is able to take in, though he always has the feeling that most of it is escaping him."

Liljefors also has made successful attempts at sculpture, the most important work in this field being his giant granite figure of a sea eagle, erected in the northern Swedish city of Örnsköldsvik. But these are minor, artistically, compared with his oil canvases, several of which he always has in progress in the many small studio cabins he has built at strategic points all over his Dannemora estate.

The artist is represented in the museums of Paris, Stockholm, Gothenburg, Helsingfors, Copenhagen, Florence, Dresden, and Munich, and also in the Brooklyn Museum of Fine Arts, which has acquired his beautiful canvas, "Sea Eagles Pursuing a Hare", a dynamic work.

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ADVICE TO A SCHOLAR

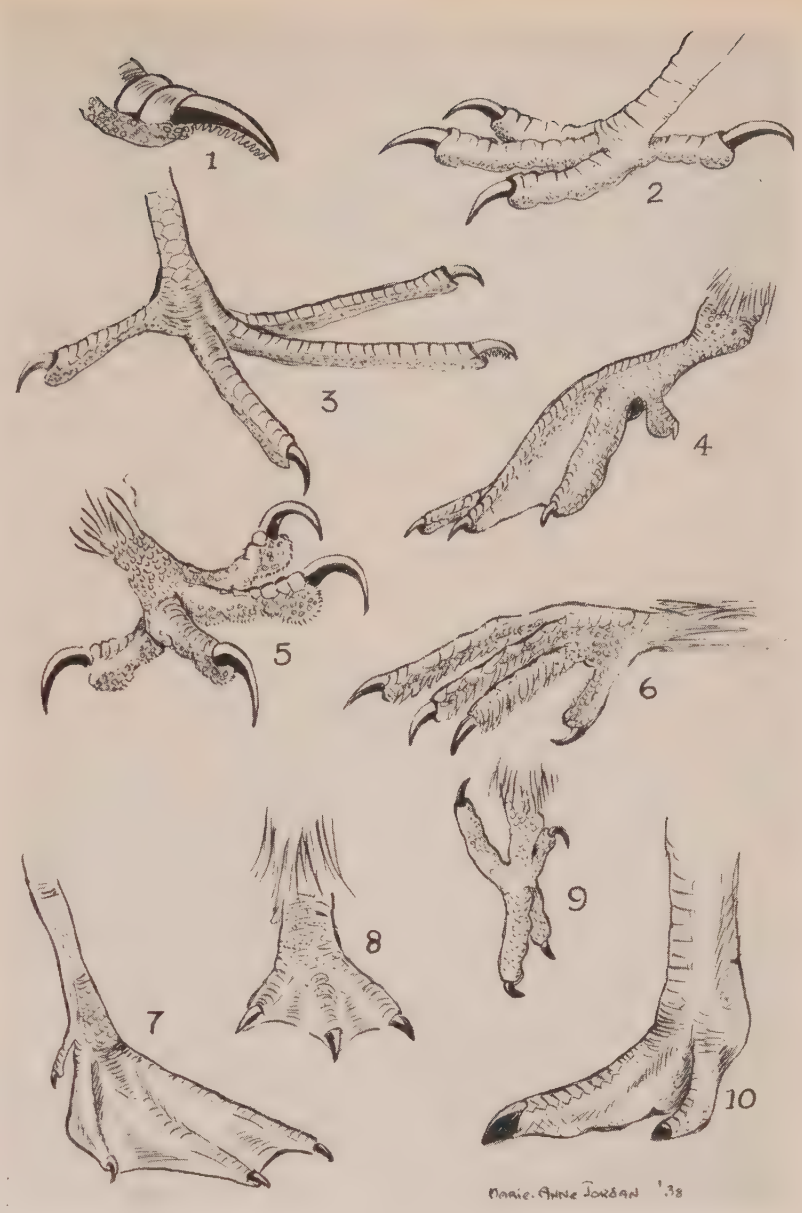
By MAUD LUDINGTON CAIN

Come, close the book! Put dusty doctrines by;
Leave pale philosophies their futile screed—
A brook, . . . a hill, . . . a wood, . . . a wind-swept sky
Hold more of wisdom human hearts may need.

Foot Work

The feet of birds are developed to serve special purposes

By MARIE A. JORDAN



1—COMB ON TOE OF HERON. 2—FOOT OF CROW. 3—HERON. 4—DIVING DUCK. 5—OSPREY. 6—"SNOWSHOES" ON GROUSE FOOT. 7—WEBBED FOOT OF GOOSE. 8—PENGUIN FOOT. 9—YOKE TOE OF PARROT. 10—RUNNING FOOT OF OSTRICH.

BIRDS are carried far and wide by their power of wing. They nest and feed in habitats that vary greatly. Thus the majority of species spend much of their lives amid trees and shrubs. In the process of adaptation to an arboreal life the feet of these birds show great modifications. But whether they spend most of their time in tree tops, on cliffs, in mud, water, sand, ice, or snow, the feet of all birds must be adapted to the demands of their environments.

The most common type of foot is found in the perching birds. These have three toes in front, with a fourth pointing backward. The tendons in the legs and feet of these birds are so arranged that the more the leg is bent, the tighter the toes clasp the perch, locking them on firmly with a clutch that does not relax, even while they sleep.

The crow has a good example of a typical percher's foot. It can perch in trees, walk like a lark, hop like a robin, scratch or claw the ground in search of food, walk on snow or ice, or wade in shallow water.

Most birds that are especially at home in trees hop about on the ground like the flicker; most of those that nest on the ground—like the quail, and meadowlark—walk or run. There are many exceptions, however.

The oriole has some skill as a weaver. These birds make occasional use of their feet to hold a strand of hair, string or other material used to fashion their nests. Some of the crow family, as the jays, hold with their feet certain food material, while they break it with their bills. The titmice have similar habits. In most cases, however, the feet of perching birds are used mainly for locomotion.

The chewink and white-throated sparrow scratch away the dirt and leaves when searching for food, kicking backward with both feet at once, instead of standing on one and scratching with the other as do gallinaceous birds.

Although the chimney swifts have small feet and short legs, they make some use of them to break off short twigs for use in nest building. A chimney swift will hold fast against an ordinary perpendicular brick wall by grasping the slight irregularities in the surface with its slender toenails. Some of the swifts not native to America have all four toes pointing forward, forming a sort of four-tined grapple by which they hang themselves up in hollow trees where they nest. None of the swifts ever alight except when resting in their nesting places or other retreats, and, therefore, are never seen on the ground. This last statement is also true of the kingfishers, which make little use of their feet except as aids in tunneling their burrows in the sand banks, and in perching. Their toes are small and weak, and the outer and middle one are joined for their length.

An odd device is found in the curious comb, or pecten, along the edge of the middle claw of each foot in the

true herons. This comb may be useful in cleaning and preening the feathers, and as an aid in removing bird lice from its body. Similar features are found on the whip-poorwill, night hawk, and barn owl.

Most woodpeckers, and the parrots, cuckoos and owls, have an unusual toe structure, with two toes in front and two behind, the first and fourth being reversed. This arrangement is known as yoke-toed. Certain species of woodpeckers, however, have lost one of their hind-toes.

The woodpeckers, who are the carpenters of birdland, must climb about readily, so their toe arrangement is perfect for this climbing. They spread out almost at right angles, holding the bird securely while it works in a vertical position.

The tiny nuthatch is the marvel at climbing. With no support from the tail, it winds its irregular way over the trunk, or branches of the tree, and when so minded seems to defy all the laws of gravitation, going down the tree trunk head first, just as easily as though it were working on a level surface.

Parrots are clever with their feet, which they use for various purposes besides walking. Their feet are as useful in many ways as the human hand. These birds can pick up with great dexterity either large or very small pieces of food, stand on one foot while they hold the food in the other, and keep turning it around as they eat it. With their sharp claws they scratch their heads, preen their feathers, or use them very effectively as weapons. They are expert climbers, aiding their feet by their stout beaks, and are quite as much at ease when upside down as in any other position. No other bird can thus equal them.

The outer toe of the owl may be moved forward or backward as the bird desires. Thus the foot may be used as a powerful vise with which to snatch and hold prey captured when the bird descends so swiftly and silently upon it.

The fish hawk, or osprey, also has a reversible outer toe, and his talons are longer than those of the owl. They are well developed for grasping and holding, which is characteristic of predatory birds. But the pads of its feet differ from those of other members of this group in that they are fitted with numerous small spines that enable the bird to hold fast to its slippery prey.

Carrion birds like the vultures have a weaker type of foot. They live on the flesh of the dead creatures they find, never transporting it, but eating their fill where it lies. Thus they have no use for their feet except for perching, or for walking a few steps.

Quail, grouse, pheasants, turkeys and all other fowl-like birds scratch with their short blunt claws, first with one foot and then with the other. Of this group the ruffed grouse has the most interesting feet. It walks about in summer over the moss and logs on slender toes, but when winter comes and the soft, deep snow covers its domain, its weight would make it difficult for it to keep from sinking at each step were it not that Nature provides it with snowshoes. A horny, comb-like fringe of pectinations grow out from the sides of each toe, thus distributing the weight over a broad surface so that the bird is able to travel over soft snow where many of its four-footed enemies would sink and flounder at every step. In the related ptarmigan the same result is effected by a growth of short stiff feathers on the feet.

Males of most of the gallinaceous birds are fighters, and, as weapons, they have developed bony outgrowths on the lower part of the tarsi, known as spurs. These are present in peacocks, pheasants and turkeys. In battle these weapons are used with great skill, and the results are apt to prove fatal to one of the contestants. Even the old barnyard rooster boasts of a pair of these spurs and he knows how to use them when the occasion demands.

Waders, which frequent the margins of streams and ponds, find their food in the shallows, so they do not have to use their feet for swimming. They have developed very slender toes and long, slim shanks for wading. This type of foot is found in the heron, crane, ibis, and others.

The coot has broad lobes of skin along the sides of each of its toes, making its feet useful as paddles and allowing it to walk about in the soft mud where it feeds, without sinking below the surface.

Ducks, geese and their kind have three front toes joined together by a web of skin, which turns their feet into paddles and makes them rapid swimmers.

A badge of membership among the diving ducks is a lobe, like a little paddle, on the hind toe. With the aid of this paddle some of these birds are able to reach a considerable depth under water.

The most aquatic of all birds is the penguin. For generations it has lived and taken refuge in the sea, and, as a result of this life, its power of flight has been abandoned. Its swimming power has been augmented by the transformation of its wings into paddles with which it cleaves its way through the water—often far below the surface—in pursuit of food. This bird's feet are short and thick, with webbed toes that are not only an aid in swimming but are extremely useful when it wishes to come out of the water. They furnish leverage for a powerful leap that lands the bird on its feet on the ice; there the feet are used for a waddling walk that may carry it for miles.

A runner touches only the toes and balls of his feet to the ground. In the course of years, Nature has developed this habit in those of her children that have found it necessary to run often for their lives. The ostrich is perhaps the best example of this type of bird. Through the process of evolution it has but two toes left on each foot, the third or inner toe, armed with a short, hoof-like claw, and which bears most of the weight, and a rudimentary fourth or outer toe, which appears to be of little use. The ostrich defends itself by kicking, and its ability to inflict injury with its blunt claw lies in the terrific force of the blow it is able to deliver. Its allies, the rhea, cassowary, and emu, each have three toes, the middle of which has a strong pointed claw, a most effective weapon of defense.

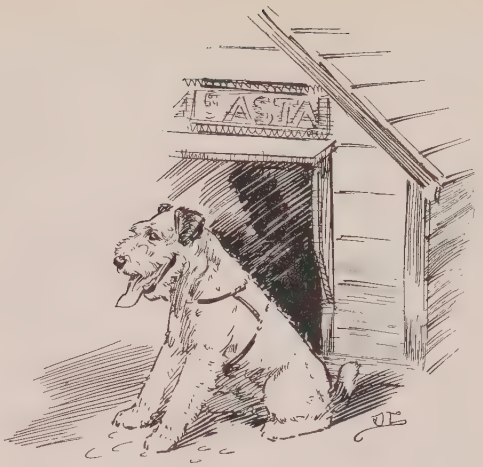
While the feet of birds serve them well in walking, hopping, running, perching, scratching, climbing, burrowing and diving, as well as in finding their food, preening their feathers and fighting their battles, there may be many other uses to which they are put.

DOGS OF FAME

And some not so famous

By DIANA THORNE

Illustrated by the Author



ASTA, FEATURED PLAYER IN THE "THIN MAN" MOTION PICTURES

SINCE the first printed word, and, long before that, in the songs of the minstrels, dogs have had their place with man in legend and lore. The ballads, some of them dating from the ninth century—British, French, Norwegian, German and Italian—are crowded with allusions to man's best friend and the part he played in defence of his master. His praises are sung for the love and devotion the dog has tendered and received from mankind. Many of the cathedrals and abbeys contain tombs whereon is carved the effigy of the dog mourned.

Down through the ages to the present day writers have found in the dog inspiration for some of their finest work. Galsworthy, Maeterlinck, Rudyard Kipling, Robert Burns and Elizabeth Barrett Browning, to name only a few out of the hundreds of outstanding names in literature, have left to us their tributes to the dog. In a book for all dog lovers, Frances E. Clarke has assembled, under the title *Valiant Dogs,* some of the greatest of dog stories, all worthy of retelling many times.

The love of dog for man and of man for dog, be the man prince or pauper, king or tramp, saint or rogue, has been the theme for some of the finest things in literature.

When King Edward the Seventh of Britain died, his smooth fox-terrier was, if not his chief mourner, certainly one of the most sorrowing. His grief was such that he refused to eat and had to be fed forcibly that his life be saved. Even with such efforts he did not live long after his master. Exactly the same case was that of the little cairn terrier left by King George the Fifth.

GARY COOPER OWNS AN AFGHAN HOUND

Elizabeth Barrett has immortalized her cocker spaniel, "Flush". When she left her home to marry the poet Browning, the only thing she took with her was her only friend, her little dog. Katharine Cornell, in that fine play "The Barretts of Wimpole Street", shared curtain calls for many months with a canine actor who shone in the part of the immortal spaniel.

The motion picture has made famous, in its short history, many dogs, among them Strongheart, Rin Tin Tin, and the weird creature in the comedies of "Our Gang". Motion picture producers have found the great appeal of dogs in pictures, and Hollywood is as crowded with dogs of personality as it is with silver-screen aspirants. Of the more recent canine "stars" one of the most recent is Asta, the personable wire-haired fox-terrier of the "Thin Man" pictures. Dogs of lineage are companions of filmdom's stellar figures, such as Gary Cooper's Afghan hound.

There are, of course, myriad dogs who, like people, have distinguished themselves without attracting the attention of poet or historian. Many of them have served in time of war, and, sadly, will serve again. They have saved lives or have gladly laid down their lives in protection of their masters'. And, as companions, they have made many a soldier's lot the lighter.

Recently, a dog belonging to the Fire Department in New York City was cited for heroism because he braved flame and smoke to save a cat and her kittens after the firemen had abandoned the building. Last year, a humane society medal was given to a fox hound, who, after hours of struggle on the ice, pulled his master out of a hole in the lake and saved his life.

One could go on indefinitely recalling stories of dogs. When dog lovers get together (Continued on page 123)

A REAL TROUPER

What Are Stylolites?

Records in rocks make fascinating reading

By C. S. GWYNNE

Photograph by Margaret Bonine Fox

PERHAPS you have wondered, seeing a piece of polished marble, the reason for the black lines that zigzag across it. Those lines are stylolites, so named from a Greek word that means a column. If you will look closely you will see that these zigzag lines are really longitudinally grooved columns that extend down into or through a part of the rock. A series of the columns across a piece of cut limestone, or marble, is sometimes known as a stylolite seam. Their appearance has been likened to a kind of writing known as hieroglyphics, or to the interlocking of the bristles on a pair of brushes.

Stylolites are not found in all specimens of marble, so don't expect every piece of marble in the post-office, the courthouse, the state capitol, or the high school building to show them. Sometimes they are present in limestone. Many parts of the country are underlain with limestone, and limestone quarries are good places in which to look for stylolites. The specimens pictured here are of limestone, and came from a quarry in Iowa.

How can these peculiar zigzag lines or columns be accounted for? For a long time they were quite a mystery. Now we think that these stylolites were at one time the plane surfaces or bedding planes between the beds or layers of limestone. They have been made rough and uneven by underground water. As the water travelled it found its easiest path along this plane, and in moving along it dissolved some of the limestone. During all of this time the rock was under great pressure caused by the weight of the rock mass above. Gradually, as solution proceeded and as pressure continued, the two beds were pushed together and the surface between them became jagged and uneven. This was because the material of the rock dissolved unevenly. So when you see a stylolite on the face of a quarry, or on a piece of marble, remember that it is not just a jagged uneven line across this surface. The stylolite continues right through the rock. And once again, as with so many curious objects found in the solid rock, it is the water soaking down from the surface of the earth that is responsible. The water left a record telling of its journey right through a part of the rock, and of the changes it made. It is left for students of rocks and minerals to read the record and tell the story.

THE TENANTS OF A FLORIDA BIRD ROOKERY

Life as it is lived in an avian "tenement" on an island in the bay at Tampa

PHOTOGRAPHS AND TEXT BY WILLIAM J. EVANS AND EDNA P. HOFFMAN

Above, an adult great blue heron stands sentinel on the sand at the rookery, while at the left a half-grown great blue, which has floundered from the nest, surveys the situation

While northern bird life is still in the icy clutches of winter, the birds of Florida are already seriously considering the business of setting up housekeeping. By April the herons will have built their nests and started rearing their families on the bird rookeries. Before they have completed this task, most of the other tenants of the rookery will be taking care of their own youngsters.

These bird rookeries, located on small keys scattered along the Florida coast, serve as veritable apartment houses for large numbers of sea and shore birds of different species. All pictured here were found on one tiny island in the mouth of Tampa Bay. The rookery was visited several times during a period of four weeks.

The noisy cormorants were the most numerous, filling the air with their discordant squawking. Their habit of disgorging half-digested food on the heads of visitors made exploration unpleasant, if not difficult. When not on their nests, the birds spent most of the time loafing

Adult and young of the beautiful American egret. On the opposite page we see the grotesque baby of the pelican and a parent bird arriving; an adult little blue heron and one half-grown little blue in the top of a mangrove

in mangrove bushes along the shore of the key.

In May large numbers of man-o'-war, or frigate, birds, which nested farther south during the early winter months, move north to roost in the rookeries and to prey on the eggs and young birds. By the hundreds and for hours, they float above the Florida shores.

More to the center of the key, where they are protected by the foliage and densely tangled mangrove roots, may be found nests of little blue and great blue herons. Both birds build their rough nest platforms in the tops of mangrove bushes. When their fuzzy brown youngsters grow older and become more restless, they sometimes fall out of the tree-tops and wander about on the marshy ground, unable to find their way back upward through the thick tangle of leaves, roots and branches. All the while their parents sit helplessly in the branches above.

American egrets build more graceful nests in which

Man-o'-war, or frigate, birds, perched in the top of mangroves; at the right, cormorants roosting in trees at the edge of the rookery

they lay two or three almost round, bluish-green eggs. This beautiful bird was close to extinction, not many years ago, because of the inroads of unscrupulous hunters who sought to supply the vast market demand for the birds' graceful white plumes. Young egrets are covered with snow white down, each strand being more than an inch in length. When their long legs grow stronger and their feathers appear, the half-grown birds scamper easily about over the tree-tops, sometimes meeting the same fate as the young blue herons.

The comical pelicans add a touch of humor to the rookeries. In full nesting plumage, the birds have white or yellow crests with rich chestnut markings on their long necks. Full-grown but immature birds retain gray heads and white breasts through several moults before reaching adult plumage.

Pelican nests may be found in great numbers on bushes close to the edge of the island. The clumsy twig platforms are about two feet in diameter and the eggs are rough and chalky-white, sometimes discolored with dark reddish-brown stains. When first hatched the babies are red and raw looking, but they grow rapidly and are soon covered with a white, powdery down. They are even more unreal and comical-looking than their parents. The youngsters possess enormous appetites, and the adult birds are kept busy flying back and forth to the fishing grounds. Even young birds can swallow a comparatively large fish. The young bird in the picture disgorged two fish that were about six inches long when he was removed from the nest. He could not have been more than two or three weeks old, and his legs were not yet strong enough to support his body weight.

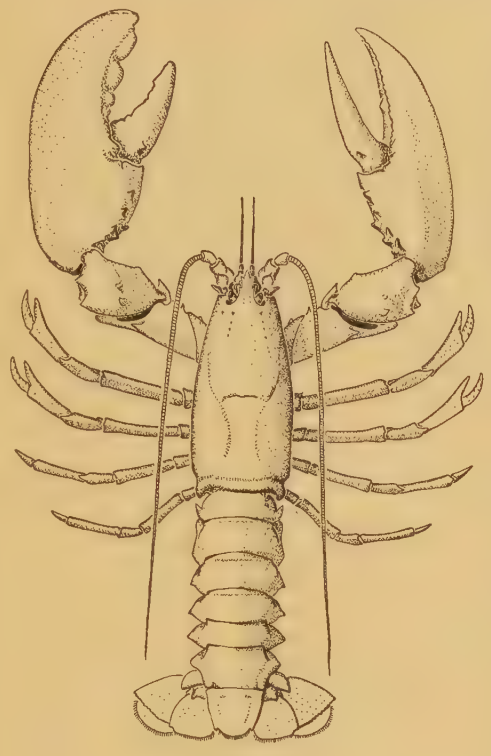
Some Common Marine Animals

The eighth in Nature Magazine's series of educational inserts

By E. LAURENCE PALMER

IN spite of the fact that an ancient writer said that "those who go to the sea are only four inches from death" men will still continue to "go down to the sea in ships", or by any other conveyance available. Those who do not will have representatives of the sea brought to them for decoration, to satisfy hunger, or to provide dyes, medicines and other articles of daily use.

The sea connects and separates nations. It brings livelihood or death to men. It modifies climates. It is the major reservoir of the waters of the earth, and undoubtedly was the cradle in which life first appeared. There is much in common between sea-water and protoplasm, and one writer has said that a mammal is little more than a glorified sack of sea-water, in which bones are comparable to the limestones that have been deposited in association with corals. It is the purpose of this article, however, to stimulate the study of marine animals rather than to suggest a philosophy of life.



LOBSTER

The sea varies almost as much as the dry land. Biologists speak of it as being the more static because the variations in temperature are not normally made so quickly, or through so great a range. At the edge of the sea, however, there are violent changes that may take place with every incoming wave and with every tide. A living thing may at one moment be exposed to intense sun on dry sand and a second later be immersed in rapidly-moving water. It may be compelled a thousand times a day to adjust itself to living first in the air and then under water. Such an existence forces on some creatures the ability to move quickly and with freedom, to modify feeding, breeding and protective activities, and to withstand excessive variations in pressure, exposure to heat and light and to a variety of enemies, both from the sea and from the land.

The depths of the sea are practically unknown and uncharted. What strange creatures live there no one knows, and what wealth of a mineral and organic nature exists there may only be guessed. We do know that some of the lesser depths are inhabited by strange creatures that carry their own lights, have mouths like the gates of doom, and whose shapes rival anything one's imagination can create. Only rarely will these things come to the attention of those who get their pleasures of the sea from walking on its shores and viewing its products.

Muds, sands, rocks and great masses of vegetation typify the major kinds of seashore, and just as these vary so does the kind of animal life to be found. An oyster must have something firm to cling to and spend the major portion of its life. Many of the crabs, on the other hand, may prefer the loose oozes into which they may sink when the occasion arises.

Life in the sea is concerned with protection and food getting. If the water is constantly shifting, food may be procured by staying still and letting it come to the hungry one. It is not, however, always easy to stay in one place on a wave-beaten cliff. Make a study of a cliff to see how various creatures maintain their positions. Many of them adopted the stream-line idea ages before automobiles were even imagined. Others, like the sea urchins, dig them-

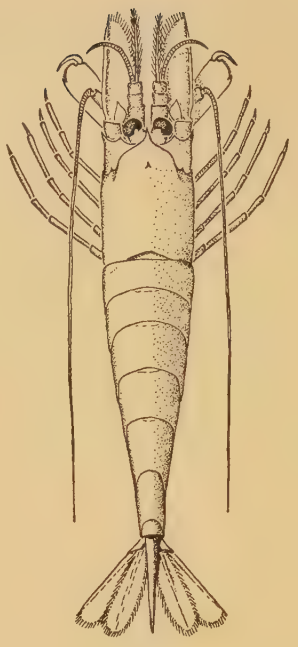
AT LEFT, THE HERMIT CRAB; AT THE RIGHT, FIDDLER CRAB; BELOW, THE COMMON EDIBLE CRAB

selves little holes in the rocks and sink into them for anchorage.

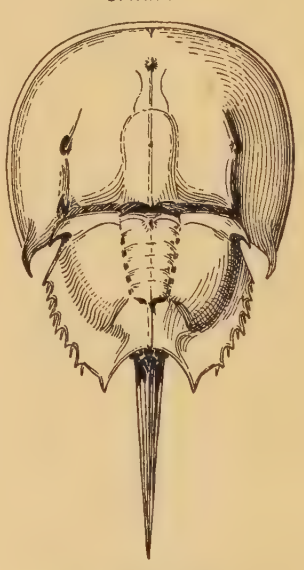
Marine animals provide an almost endless assortment of types of swimming. The crabs move sideways with incredible speed; the scallops flop like butterflies; some forms swim backward, others forward. All are interesting. They may swim by bending their bodies, flipping their tails, waving their antennae or squirting water from inside their outer coverings? Try to find out their methods from your own observations. Free any little marine creature that you may capture in a pail of water and see what it does and how it does it. Those forms that are free-moving may move fast enough to be timed easily, but some forms that bore their way into rocks must be checked from day to day to show progress.

Of course marine creatures often have seasonal movements, just as do the dwellers on the land or in the air. The horseshoe crabs, lobsters, true crabs and certain fishes are possibly the most interesting in this connection. Fishermen who learn about these migrations are generally the most successful in making catches. Unfortunately too much knowledge about these habits by selfish humans may not be good if the supply of marine forms is to be maintained. If fishermen knew less about the movements of lobsters the supply might last longer. On the other hand, if information is used wisely, practices may be established whereby the surplus stock may be harvested without interfering with the breeding stock that maintains the supply. Laws should be based on facts and should be applied wisely to each situation, and there is great seasonal variation in the habits of all living things. Sometimes this is recognized and sometimes it is not.

Most people who have had some experience with small marine animals use caution in handling anything strange to them. They know that they can get stings from some; vicious pinches from others. Some, like the squids, may squirt unpleasant liquids; others may rasp the skin or produce a rash. A foot cut on a coral or pierced by a sea urchin is not pleasant, and a jelly fish or a Portuguese-man-of-war may be a thing of beauty, but, mishandled, not a joy forever.



SHRIMP



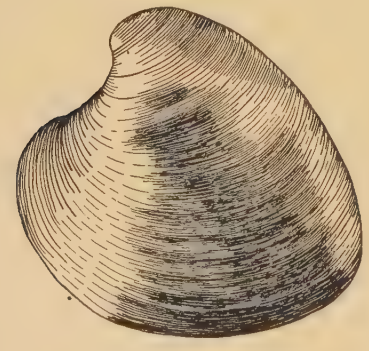
HORSESHOE CRAB

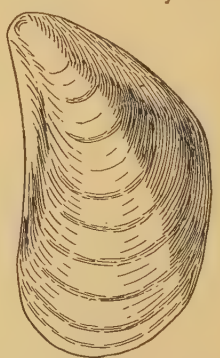
Some marine creatures protect themselves by less violent means. Some need only an opportunity to reproduce. A shipworm, for instance, may lay 2,000,000 eggs, and with this number of offspring the supply may easily be maintained if only a few reach maturity. See how many of the animals listed in these charts use this technique of maintaining their kind on the earth. Fortunately many marine forms have effective protection when they are older and in a fixed position. When they are free-swimming, like the young of oysters, they are in the hands of fate, which decides whether they will become a meal for some larger animal or will grow into an adult capable of perpetuating the species.

Make your own classifications of the methods used by the small animals of the shore for protection. Do not be too disturbed if you cannot name everything you see. You still have your own senses and can use them for getting information for yourself.

Some people seem to think that other creatures should be made in the image of human beings. Other creatures should have their eyes where we have them. They should breathe as we do and have similar experiences. This, of course, is not the case even though some Nature writers seem to imply that it is.

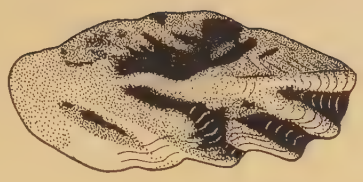
Sit on a pier over some clear sea water and see if a shadow made by your moving arm makes any difference in the appearance of the animal life under water. Try this wherever you can and if you have some strange creature captive in a pail of water try to find out how he learns of your





ABOVE, A BARNACLE; AT LEFT, THE COMMON CLAM; BELOW, A SEA CUCUMBER; AT RIGHT, THE COMMON MUSSEL

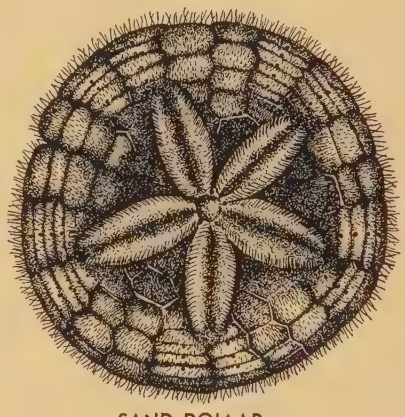
presence. Can he see you, or does a slight vibration produced by jarring the pail bring quicker results? You might even decide in what part of the captive's body its sense organs are located. If you wish some suggestions on this point read the accompanying charts to find how some of these creatures get acquainted with what is going on in their immediate vicinity.



OYSTER

Some of the things to investigate about the sensitivity of captive marine animals might be centered around what they see; what they hear; what they feel; their ability to taste freshness or saltiness in water; their reaction to changes in temperature and the temperature ranges at which they are most active; their reactions when placed in the air; when turned bottom-side up; when put with others of their kind. Common sense should suggest to anyone who would investigate these things how it may be done.

SEA URCHIN



SAND DOLLAR

Even as with us, the getting of food is important to small marine animals. How some do it is obvious; with others it is not easily observable. It should be sufficient for the purposes of this article to suggest those that may be easily demonstrated. Most haunters of the seashores have had the opportunity to watch crabs and their kin feeding. There are few things more interesting, and one regrets that they do not have the ability to express enjoyment of a feast. The fiddler crabs are among the most interesting. The males of these crabs have one of the claws so greatly enlarged that it cannot be used to convey food to the mouth, thus the females can get more food in a given time than their mates. With these crabs the food is largely small plant materials rolled into little balls and eaten where it is collected, or carried into burrows for consumption. How many other marine creatures available for study carry the food to the mouth by claws?

STAR CORAL

A sea squirt brought out of its element begins to expel little streams of water at intervals. This may suggest how it gets its food. The animals live in little colonies, each colony expelling the water through a common opening. The water brought in carries with it micro-organisms that have food value. These are strained out before the water is expelled. How many other seashore animals get their food by drawing in and sending out a stream of water? With some animals this water current is associated only with respiration. With some it is associated with escape, but with many it is the chief device for food-getting. While working with some creature that does use this technique, try to see if it can be made to reverse the direction of the current. Can it, for example, start to take in some liquid; find it unsuitable and expel it through the opening through which it entered?

We cannot here give summaries of the economic angle of marine invertebrate animals. Look through your local state reports to see what the income may be from marine life. Compare this with the income from hay, wheat and other agricultural products. It may surprise you, for example, to know that the financial returns from shellfish in a state like New York, with its small shoreline, is almost equal the returns to the state from growing wheat, and exceeds that gained from growing either barley or buckwheat.

Government projects that are likely to change the flow of water through the different channels to the sea may so change the salinity of the water of different bays and harbors that existing sources of revenue from shellfish may be completely destroyed. This has not always been recognized by the politicians. It is economically important, then, to many people that there be a more general understanding of the needs of these interesting and economically important fellow inhabitants of our earth. Continued pollution of our streams and seashores by the work of industry is a constant menace to such forms of life.

(Continued on last page of insert)

NAME	LOBSTER *Homarus americanus*	BLUE CRAB *Callinectes sapidus*	FIDDLER CRAB *Uca*	HERMIT CRAB *Pagurus*
DESCRIPTION	Length, up to two feet; weight up to or more than 28 pounds, although average weight nearer two pounds. Color, dark green above with darker spots, yellowish beneath. First pair of claws very large and used as pincers. Back part of body jointed to turn under body.	Shell about 2½ times as wide as long; good-sized male, 2½ by 6½ inches; females, smaller, with smaller claws. Apron under male, inverted T; of virgin female, equilateral triangle with concave sides; of fertile female, a plump triangle. Gray or blue-green; red spines.	Shell width, up to one inch; length, 3/5 inch. Color, light brown or purple and dark brown. In male, one claw, usually the right, much larger than other; pincers of female about equal in size. Eye stalks, very long and slender.	Found as occupants of spiral shells; the rear, soft parts protected by the shell, and the claws form a cover over the shell opening. Great variation in the species and in shells occupied. Abdominal appendages of female modified for egg-carrying.
HABITAT	In shallower salt water in summer and in deeper waters in winter. Very young forms swim at surface six to eight weeks.	In shallow salt or brackish water chiefly on mud bottoms near river mouths where vegetation is abundant.	On mud and sand flats, at tidewater in burrows, at low tide on surface.	In shells on sea shore, in deep water, or on land, depending upon species; some live in trees much of their lives.
RANGE	Common along Atlantic coast from Labrador to North Carolina.	From Cape Cod south to east coast of South America, sometimes in fresh water adjacent to salt water.	From Cape Cod to Florida with other species in same area and on Pacific Coast. Generally common, conspicuous.	*P. longicarpus*, small, from Maine to South Carolina; *P. pollicaris*, large, from Maine to Florida, deeper water.
RELATIVES AND LIFE HISTORY	Arthropoda. Decapoda. Family Homaridae. American species, two. A 15-inch female may carry 100,000 1/16-inch eggs under abdomen, 10 to 11 months. Young at surface two months, through five or six moults; go to bottom as one-inch lobsters. Moult about 16 times first year (two to three inches long); by five years, mature, have moulted about 25 times and reached 10-inch length. Eggs at seven years, every other year. Hatch June.	Family Portunidae. Eggs, light orange-yellow to brown; one to five million; in mass carried by female; hatch into free-swimming "zoea", followed by quieter "megalops" which develop into crab forms. Summer hatch transforms by winter. Moult weekly; later, monthly, increasing in each moult about ⅓. Mature, third summer. Adults do not moult, may live four years. Males carry females before final moult. Females mate once.	Arthropoda. Decapoda. Family Ocypodidae. About seven American species; the group, cosmopolitan. Male courts female with fiddler-like motion of huge claws. Young freed into water usually on incoming tide. Free-swimming stages precede transformation to adult forms. Adults find refuge in holes rather than in water.	Arthropoda. Decapoda. Family Paguridae. Some 20 genera and more than 100 species of hermit crabs. Coral-colored eggs, about size of mustard seed, hatch early in year into "zoea", free-swimming stage; followed by symmetrical "glaucothoe" stage that lasts four to five days. This is followed by shell-occupying period. As crab grows, larger shells taken from dead molluscs, or are wrested from less powerful hermit crabs; transfer rapid.
BEHAVIOR	In males, first appendage of abdomen is hooked; in females, normal. Feeds largely on living or dead animal matter; very little plant food. Protected by shell, by ability to fight and to conceal themselves. Most helpless when swimming at the surface as young or just after moulting. Have definite seasonal migrations to and from deep water, influenced by temperature and age.	Crawl or swim along bottom. See fairly well. Food, dead animal matter. Eat each other if crowded. Defend selves by escape and by claws. Enemies, fish, also barnacles and bryozoans, which clog respiratory system. Males vigorously defend virgin females from rivals; may carry mates two days before mating and two days while mating. Females may produce two lots of eggs a summer the first several weeks after mating.	Small, pugnacious crabs, found in great droves. Food mostly small, plant materials rolled into pellets, often carried into burrow for use. Females use both claws in food-getting; males, the smaller only. Run sidewise, the males commonly holding larger claw in a threatening attitude when frightened. Obviously able to sense vibration in the soil. May make noise as they bump each other.	Great fighters, readily attacking and killing own kind but retiring to protection of shell in presence of more powerful enemy. Corals, sea anemones, and other animals frequently find resting places on the shells. Walking done by second and third pairs of legs, the first pair being used in fighting and in food-getting. Walk surprisingly fast.
SENSITIVITY	Sensitive to light, to pressure, to chemical nature of water. Use antennae as sense organs. Prefer water temperature about 55°F. Individual may range 12 miles in three days; dig holes into which they retreat tail first; young transparent.	In summer, live close to shore; in winter, in deeper water; larger males favor deeper water. Soft-shelled, newly moulted forms hide. Build no permanent homes. Swimming movement so rapid animals appear like a flash. Run sidewise.	Build burrows ¾-inch in diameter and two or more feet deep. In retreat, males pull large claw in last, emerge large claw first. *U. minax* found farther from sea than others, in fresher water. *U. pugilator* favors sand or mud near high water.	Interesting to experiment with these animals to detect their ability to recognize position, disturbance, light, and other factors; highly sensitive to certain stimuli such as light, touch, and water-pressure.
USE TO MAN	Probably our most valuable crustacean. In past, more than 100,000,000 captured yearly, worth between one and two million dollars. Useful also as scavengers and as food for valuable food fish.	Valuable as scavengers and as food for man. Caught in nets or on lines baited with dead animal matter. Sold fresh, or cooked and canned. Provide some sport and, for many persons, a meager livelihood. Value, one-half million yearly.	Of some value as food for enemies such as birds and fishes; may burrow through dikes and cause damage; serve essentially as scavengers but are always interesting to watch.	Serve as scavengers, as food for fishes and other animals, and as means of locomotion for animals that live on the shells; one sea anemone consumes shell of host crab and provides direct protection for the crab.

SHRIMP *Crago septemspinosus*	HORSHOE CRAB *Limulus polyphemus*	BARNACLES	SCALLOP *Pecten irradians*	CLAM, QUAHOG *Venus mercenaria*
Length, two inches. Second pair antennae, long. Claws on second pair of leg-like structures back of mouth, with pincers. In Palaemonidae first two pairs with pincers and in Peneidae, pincers on first three pairs. Color, light with dark markings. Sexes, separate.	Crab-like animals up to 20 inches long with slender tail and broad, flat fore-part consisting of abdomen and broader fore-section. Relatively flat; males, much smaller than females. Two large separated eyes, and smaller pair close together.	Goose barnacles, or ship barnacles, with a five-pieced shell protecting feet and body and borne at end of stalk ½ to one foot long. Rock barnacles, Balanidae, stalkless with six-pierced shell joined by thinner shells to enclose soft body. Sexes usually not distinct.	Two shells, one flatter than the other, with straight hinges without teeth. About 20 radiating ribs on shell and abundant lines of growth. Up to a foot across, commonly much smaller. Edges of mantle may stick out of shell, with 30 to 40 bright blue eyes.	Up to 5½x4½x3 inches. Dirty white with prominent, eccentric ridges on each shell. Inner surface of shell dull white with the lower margin purple or violet. Shell margin, slightly uneven; hinge, with three spreading teeth in each valve. Sexes distinct.
Sand shrimp found commonly on and in sand at low-water mark and in shallow water below low-tide mark on to 300 feet.	In shallow sea-water or along shore in sand at breeding time; below low-water mark unless washed up by storm.	Ship barnacles on ships, piers, and logs under sea water. Rock barnacles on rocks, common between high- and low-tide marks.	In shallow salt-water bays where bottom is covered with sand or seaweed, on mud flats, or to hundreds of feet deep.	Common on sandy and muddy sea-bottoms from tide levels to 50 feet under the sea. Commonest in shallow bays.
This species from Labrador to South Carolina, in Europe, and on the Pacific Coast. Others replace it on other shores.	Along Atlantic Coast from Maine to Mexico with related species along eastern coast of Asia.	Ship barnacles world-wide in distribution, particularly abundant in tropics. Rock barnacles also cosmopolitan.	Nova Scotia to Texas, though most common in eastern Long Island Sound. Closely-related species range world-wide.	On coast from Nova Scotia to Yucatan; most common from Cape Cod to South Carolina. Other species extend range.
Arthropoda. Decapoda. Family Cragonidae. Eight American species. About 17 families of shrimps and prawns include several hundred species. Young of this group spend some earlier stages in eggs; this not true of all shrimps. Some from South go through four larval stages, "nauplii", "protozoea", "zoea", and "mysis", these being passed in egg in some forms.	Arthropoda. Arachnoidea. One genus with five species. Mate in early summer when large females come to shore bearing one or more smaller males each hanging to tail of animal ahead. Eggs laid in sand in hole made by female, fertilized by males and left for waves to cover; hatch, mid-summer. Young crabs, which may cover beach, finally make way to sea and disappear until well-grown; young lack spine-like tail.	Arthropoda. Order Cirripedia. Families Lepadidae and Balanidae. About 30 species of ship barnacles and 75 of rock barnacles. Crustaceans. Eggs carried outside fold of skin beneath shell. Young, free-swimming animals in "nauplius" stage; swim near surface; moult to two-shelled "cypris" stage, and swim about with butterfly-like motion; finally fasten to support for rest of life, and shed swimming legs.	Mollusca. Pelecypoda. Family Pectinidae. Breed in early summer and grow so rapidly that by winter may reach a length of one inch. After a free-swimming stage, which develops from the fertilized egg, attach themselves to submerged objects by stems secreted by glands in the feet. Here they develop to from one to one one-half inches across. Then take up a roaming life. Live about four years.	Mollusca. Pelecypoda. Family Veneridae. Several hundred species. Very small eggs expelled into the water by female; hatch, after fertilization, in about 10 hours into shell-less free-swimming stage, which lasts a day; shell-forming stage of six to 12 days follows. Settle to bottom and remain attached until one-half inch long; adults burrow. May live four to five years, lengthening about one inch a year.
Breathe by gills, which are hidden in the sides. Swim by flexing the abdomen, which ends with a tail fan and has swimmerets beneath to help in swimming and in carrying eggs. Walking done by legs of the middle part of the body. Head and thorax joined. Food captured by means of pincers as in crayfish, lobsters and crabs.	Walk with four pairs of forward feet, swim with hind feet, and burrow with help of shell. When moulting, shell splits on front edge. Not particularly aggressive animals. Animals are midway between the crabs and the spiders, with some characters of each. Survivors of a group of animals once abundant on earth but now represented largely by fossils. Burrow freely in sand and mud seeking small animals for food.	Animal lies on back inside shell and, with legs extended from shell, forces stream of food-bearing water to mouth; movement of legs shows clock-like regularity. When feeding, a mass of barnacles takes on a different appearance because of presence of moving legs.	Adults move by flapping the shells, which produces a zig-zag motion something like the flight of some kinds of butterflies. A single flap of the shell is accompanied by a jet of water and may move animal several feet. Food, minute forms of life taken in with the water that is used in breathing. Have rather definite seasonal migration. Are somewhat gregarious.	Wide, muscular, white foot permits burrowing in sand or mud. Water, carrying food, enters through short, blunt, yellow "siphon". Water leaves through opening nearest shell hinge. Food, microscopic or minute materials collected on gills and forced to mouth by cilia. Undesirable material rejected in outgoing water. Withdraw into shells when disturbed.
Some able to change color to match surroundings. Most are sensitive to disturbance and to light changes. Vary in amount of care given young by mother. Hide when disturbed. *Penaeus setiferus* in New York and southward.	Air-breathing animals even though they live in the sea. Rarely found above high water mark or in fresh waters. Protected largely by back covering and position close to sea bottom, or by being partly buried in bottom.	Highly sensitive to jar, particularly the rock barnacle. Some species live on whales, some in dogfish, and others in various unique places. In some, males are small animals without mouths or intestines, which live within the female.	Eyes, which border the mantle, often glow and provide power of sight; scallop takes fright at a mere passing shadow. Between the eyes are delicate feelers which are sensitive to disturbance. Close shells quickly when alarmed.	Highly sensitive to touch, to chemical nature of environment, and to mechanical disturbance. Soft bodies of some species not completely covered by hard shells. Soft-shelled clam lives in burrow.
Shrimp industry of great importance, particularly on Gulf Coast, Pacific Coast, and along Atlantic Coast of Southern States. Animals provide basic food for large numbers of food fish whose value is great; also valuable as bait.	Considered by some to be good food, but more commonly fed to hogs and chickens or used as fertilizer; not generally considered of economic importance in spite of their size.	Some species, food for fish; some, food for man. Ship barnacles, by covering ship bottoms and delaying swift movement, cause much expense to ship owners; do little actual damage to ship.	Muscles eaten by man. Basis for industry of several hundred thousand dollars. Captured by dredging but abundance varies greatly. Shell basis of art designs; in middle ages, one species had religious significance.	Quahogs worth more than $200,000 annually; soft-shelled clams more than twice as much. Shells of quahogs used by Indians in making wampum; blue portion most valuable.

NAME	OYSTER *Ostrea virginica*	MUSSEL *Mytilus edulis*	STAR CORAL *Astrongia danae*	SAND DOLLAR *Echinarachnius parma*
DESCRIPTION	Length, up to 18 inches; more usually, four to five inches. Two shells; upper, usually flat, and lower more convex; attached to bottom by left shell. Exposed shell very irregular, thick, or in folded layers. No foot present in adult. Sexes distinct, or both in an individual.	Length, to four inches; width, one-third length. Shells, about equal; pointed at front; round, behind; smooth; violet to dark brown, pearly within with violet margins. Attachment, a fibrous "byssus" belonging to cylindrical, grooved foot. Gills, rows of filaments.	Expanded polyps, one-eighth-inch wide, three-eighths-inch high, becoming practically invisible when contracted. White, glassy, translucent, and with 18 to 24 white-speckled, knob-ended, long, tapering stinging tentacles. Skeleton, like crowded, six-sided cups.	Flattened discs, more or less circular, less than three inches in diameter, covered with minute spines and bearing what appears to be a five-parted flower-marking in the center. Mouth, in center. Color, purple to grayish. Sexes, distinct.
HABITAT	In shallow brackish water, commonly on hard bottoms, and more commonly at or near mouths of rivers.	In sand or mud attached to rock or to each other between the tide lines or in shallow salt or brackish water.	Form crusts on shells or stones in shallow sea water. Few kinds found deeper than 300 feet.	In the sea, from tide marks to great depths, usually on sandy bottoms. Often washed up on beach after a storm.
RANGE	From Gulf of Mexico to the Gulf of St. Lawrence and introduced on the Pacific Coast, where it has become established.	Around the world, generally north of San Francisco and North Carolina. Common in European waters.	This species, Cape Cod to Florida. Other species of corals in most of the warmer seas of the world.	Common on the Atlantic Coast north of New Jersey and on Pacific, south to Puget Sound. Others extend range.
RELATIVES AND LIFE HISTORY	Mollusca. Pelecypoda. Family Ostreidae. At least three species. Females produce about 9,000,000 1/500-inch eggs. Fertilized eggs hatch in about five hours into free-swimming creatures. At 32 hours, shells appear; in six days, shells enclose soft parts; in three weeks, shells may become fixed as "spat" (still microscopic); growth more rapid, one-quarter-inch across in 10 days, two inches in 82 ideal days.	Mollusca. Pelecypoda. Family Mytilidae. Several hundred species in the family; species vary in size, color, and edibility. Sexes, distinct and sex glands distributed through the animal. Tiny, yellowish eggs found almost anywhere, as in foot, gills, or other parts. A California species may lay 100,000 eggs yearly, these developing to three and one-half-inch animals in a year.	Coelentrata. Anthozoa. Family Astraeidae. American species of genus, four. More than 1000 stony corals in world and more than 2000 corals of all kinds. Like sea anemones, which deposit lime between sections of barrel-like base. Reproduce by dividing, by buds, or by eggs that develop into free-swimming larvae which soon start a new colony.	Echinodermata. Echinoidea. Family Scutellidae. One of the sea urchins. 20 species in the family. Eggs and sperms thrown into seawater by parents, and fertilization takes place. After a larval stage known as the "pluteus," the young assume the form of the adults. In this species, intestinal opening on the margin.
BEHAVIOR	Sexually mature when two years old. In this species, males and females distinct, though not distinguishable externally. Food, minute plant and animal matter drawn in with water used in breathing. Waving hairs on gills cause water current. Heart, in freshly opened oyster, appears as delicate bulb, beating close to the inner side of great muscle which closes shells.	Move about by means of glue-like threads put out at will. Often tip of mantle protrudes from separated shells. This attracts fish that may come too close, and be captured by the closing shells. Food minute organisms in the water. Shells snap shut quickly when animal is disturbed. Those unable to close shells should not be eaten by man.	Colony tends to form as a crust on stones, shells and the like. Sensitive creatures whose moving tentacles force animal food towards gullet or paralyze prey. Can reduce size, withdraw into stony base, and in various ways injure small enemies. Stream of water forced in and out provides food, waste-disposal and oxygen. Direction of stream may be changed by waving cilia.	Slow-moving animals, usually partly buried in sand or on edge with the mouth downward. Sand is taken in with the help of spines and from this the food, minute plants and animals, is selected and digested. Spiny covering and lack of any considerable fleshy portion provide some protection. Closely resemble fossil species.
SENSITIVITY	Sensitive to heat, to chemical nature of water, to touch and either to sound or to vibration. Close at a noise. Sanitary practices demand that water reaching commercially harvested oysters be unpolluted.	Sensitive to touch and to amount of salt in water. Find protection from many enemies through shell and position in mud, sand or on wave-beaten rocks.	Sensitive to disturbance of environment and to chemical nature of potential food. Corals of the large-colony type in part responsible for the building of great land areas, and also for dangerous submarine reefs.	Able to recognize whether right side up. Can turn over on a sandy bottom but not on a hard surface. Moving spines resemble waving grain. Hardy, and may be kept in salt-water aquaria.
USE TO MAN	Most valuable shellfish, with an annual market value of over $16,000,000. Rarely contain pearls. Often shelter small, soft-bodied, female oyster crabs, *Pinnotheres ostreum,* males of which are free-swimming and hard-shelled.	This species used for food and in France and other parts of Europe has long been cultivated with profit. Mussels are sold in markets on east coast and west coast of America. Have a unique color when cooked. Commonly used in chowders.	Rôle in forming lime deposits makes significance of corals tremendous and not limited to seashore. Fossil corals of world-wide distribution. Their presence in a geologic formation may indicate clear, relatively shallow seas when deposited.	The skin and spines, ground and mixed with water, make an indelible ink.

SEA URCHIN *Arbacia punctulata*	STARFISH *Asterias forbesi*	BRITTLE STARFISH *Ophioderma brevispinum*
Body up to one and three-quarter inches through, protected by a skeleton (test) of lime plates under skin; covered with stout spines up to three-quarter-inch long arranged on five broad areas separated by narrow areas. Mouth underneath, five white teeth.	Usually five arms radiating from central disc. Width, up to six inches or more. Color, greenish black; usually small orange plate near base of two arms. Upper surface with coarse spines; below, rows of tube feet for walking. Mouth, beneath. Sexes, generally separate.	Central disc, five-sided, thin, about one-half-inch across with five slender arms each about one and one-half to two and one-half inches long, extending from corners; green or brownish gray. Arms appear segmented, tips often broken. Disc, rough. Sexes, separate.
On sea-bottom from tide marks to 700 feet, on sandy or rocky bottoms, also in depressions in rocks.	From seashore to a depth of 180 feet. Ordinarily common. Larger in northern Pacific species.	From the shore to depths of 700 or more feet; more abundant in the deeper waters, where it crawls over bottom.
This species from Cape Cod to Yucatan, with other species making sea urchins world-wide in distribution.	Atlantic Coast from Maine to the Gulf of Mexico with other species extending range in east and in the Pacific.	From Cape Cod south, with other species extending range on coasts of Europe, Pacific Ocean, and tropics.
Echinodermata. Echinoidea. Family Arbaciidae. Some 500 different living sea urchins known and some 2000 fossil forms. Eggs expelled from five pores near summit of body, develop into clear larvae with reddish spots and eight rods. Swim for several weeks, then in a few hours, change into minute sea urchins about size of pin-head and settle to bottom.	Echinodermata. Asteroidea. Family Asteridae. About 1000 living species known. When broken in two, reproduce new individuals by regenerating parts. Eggs laid in water in late June hatch into transparent larvae that swim at surface; feed on minute animals until about one-third-inch long; in a few hours, take starfish form and settle to the bottom. May reach two and one-half-inch size in a year and breed.	Echinodermata. Ophiuroidea. Family Ophiodermatidae. Some seven families. More than 1000 species. Egg sacs, each with two openings, in pairs on lower side of disc between arms. Water circulates through egg sac, possibly to supply oxygen. Eggs freed from sacs when fertilized become free-swimming forms, "pluteus", which transform into adult form and settle down for life on bottom.
Mouth provided with five teeth and strong muscles which grind the animal and vegetable food. Teeth grow constantly as worn down. Teeth and jaw parts, called "Aristotle's lantern," often found on shore. Sand taken in with food may be ground fine before being freed into sea at opening at top of animal. Spines movable. Five double rows of sucker-bearing tube feet.	Young eat as many as 50 young clams in six days and destroy useful sea forms throughout life. Pull prey from bottom and if cannot open shells of prey completely, thrust digestive parts into opening. A large starfish may exert a pull of two and one-half pounds on shells of a clam which it wishes to open. Move by tube feet on under side of arms. Can regenerate some parts.	Rather active animals with snake-like motion and appearance, causing name "snake-skin stars", or "serpent stars". The name "brittle star" refers to tendency to break into parts. Lost parts are easily restored. The closely related basket starfish walks on tips of branches of arms.
Some have poisonous spines. The soft parts often decay, leaving the flattened, sphere-like "tests," minus the spines, on the beach. Some cover selves with vegetation for added protection.	Can right self if placed on back. Sensitive to light, disturbance and chemical nature of environment. Red eye-spot at tip of each arm; no other special sense organs. Water enters through orange plate on upper surface.	No eyespots evident on the arms, but the retreating action due to a passing shadow proves light sensitivity. Also sensitive to pressure and to chemical nature of water.
Internal parts, principally eggs, which may number 20,000,000 per individual in some species, are used as food, particularly in southern Europe. Marseilles fish market handles 100,000 dozen yearly.	Destroy millions of dollars worth of shellfish on coasts of America alone. One of the greatest enemies of oysters and clams. Fishermen who formerly cut starfish to pieces to kill them were only increasing them as each part became a new animal.	Interesting to collect because of difficulty in obtaining perfect specimens. Fossil starfish found in Devonian and Silurian rocks connect common starfish and "brittle stars".

ACKNOWLEDGMENT

This article is a modification of a similar one by the author published in the *Cornell Rural School Leaflet*. Appreciation is expressed to the New York State College of Agriculture at Cornell University for permission to make these modifications. The author has had first hand experience on most of the important beaches of the Atlantic and Pacific coasts of the United States and in Hawaii and Jamaica. These personal experiences have been supplemented by the use of standard publications on the subject. In the present case the more useful of these are included in the following list.

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Sea-shore Life, by Alfred Goldsborough Mayer. The A. S. Barnes Company, New York City. 1916.

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A Manual of the Common Invertebrate Animals Exclusive of the Insects, by Henry Sherring Pratt. P. Blakiston's Sons and Co., Philadelphia, Pennsylvania. 1935.

Parade of the Animal Kingdom, by Robert Hegner. The Macmillan Company, New York City. 1935.

The Tide, by H. A. Marmer. D. Appleton-Century Company, New York City. 1926.

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The Shell Book, by Julia Ellen Rogers. Doubleday, Doran and Company, Garden City, New York. 1908.

Florida Sea-Shells, by Bertha D. E. Aldrich and Ethel Snyder. Houghton Mifflin Company, Boston, Massachusetts. 1936.

Handbook for Shell Collectors, by Walter Freeman Webb. Published by the author, Rochester, New York. 1936.

Oyster Biology and Oyster Culture, by J. H. Orton. Edward Arnold and Co., London.

What Shell is That?, by Percy A. Morris. D. Appleton-Century Company, New York, London, 1939.

LEFT, STAR FISH; ABOVE, SEA SQUIRT; RIGHT, BRITTLE STAR; BELOW, SCALLOP

(Continued from third page of insert)

THE HISTORIC ANGLE

Seas and the life in and near them have left long and interesting histories that those who wish may read. Sediments originating in inflowing fresh-water rivers or on wave-beaten coasts are constantly settling on the sea-bottoms. These sediment deposits have been built quickly in some places and slowly in others. They may be of great depth or shallow. In general, the heavier sediments have settled near the shore lines and the lighter ones at points more distant from the place of disturbance. Often near the shores the sediments in suspension are sufficient to cut off the light that otherwise would penetrate deeply into the sea. Consequently, life that demands light has been unable to survive in the roiled waters. The relative effect varies, of course, with different kinds of marine life. The presence of a living coral in a present-day sea at considerable depth is almost conclusive proof that the waters above are relatively clear. Observations of this sort are tremendously important if we wish to interpret the conditions in which ancient sediments were laid down.

Within the year, the writer spent a number of days combing an ancient seashore in central Arkansas. Oysters were found with shells near a foot and one half long. Some of these oyster shells had been drilled by other molluscs whose remains were found associated in great abundance. Barnacles still clung to the outer surfaces of the shells of the oysters. Other small forms of marine life left their records of the past, just as they are now doing on any coast. The essential differences are that many of the creatures whose remains we found on that shore are not living today. The most interesting of these was one bone of a whale, the only one of its kind ever to have been recorded from this far north, or in the State of Arkansas. This was found by another member of the party, but was equally appreciated by all.

The story of these ancient seas and how they have carved this and other continents will be told in a later insert in this series, but, meanwhile, our readers would do well to examine whatever local rocks appear to have been laid down as sediments. How many of these contain the remains of plants or animals? Do these resemble modern plants and animals of the sea, or are they like those of the land? Are the sediments coarse or fine and how do they resemble those now being laid down in local waterways?

Of course, as sediments are laid down in the seas they add weight to that particular locality. At the same time, there is less weight pressing down at the places where these sediments were broken free by the wind or water. This must mean a great variation of pressure at different points on the earth's surface. This variation may easily lead to some change in the elevation of the surface, although such change would probably be the result of a combination of forces rather than just this one.

With these seas varying in depth through the ages, some may have become separated from the greater bodies of water. On occasion some of these dried up, leaving minerals of different kinds deposited on their bottoms. Great salt beds have been laid down in this way in the past, and are still being formed under suitable conditions. Then, too, these shifts in the elevation of different points of the earth's surface have produced important changes in the local weather, and these changes have so changed the soils in different places as to affect the success of agriculture as now carried on. Thus it is seen that what went on in these ancient seas is of more than academic interest to us today.

The future of civilization of course depends greatly on man's ability to understand and master the seas. Political and economic isolation is important but possibly results of more importance may arise from harnessing the forces of the tides, or in utilizing the great variation in the temperature of different parts of the sea. Wisely used, the sea can solve many of the fundamental food needs of man and it is obvious that we have only begun to understand its real possibilities. It offers one of the widest fields now available for research and discovery.

NATURE'S IRON PIPES

By FRANK J. THOMAS

One of the strangest forms of mineral limonite is that found in a New Jersey sand pit. These cylinders of iron ore are about eight to twelve inches below the surface of the ground. When dug up and emptied of the sand packed in the interior, they look exactly like old rusty iron pipes. For this reason it is called "pipe ore".

The pipes are detected by looking at the sloping edge of the bluff until a circular cross section is seen. Then the surface sand is scraped away and the length of pipe ore removed. The pipes are frequently several feet long, but are so fragile that it is difficult to obtain an unbroken piece longer than about fifteen inches.

Limonite generally is distributed in the ground in earthy lumps or botryoidal masses. Most of the mineral found in this sand pit is in chunks. The cylinders are comparatively rare, and striking when first seen. Geologists are mystified by this shape and have no satisfactory explanation to account for its formation.

The deposits were laid down in the Cretaceous Period. This was about one hundred million years ago. This sand pit was then covered by the ocean. The cylinders and chunks of limonite were made by the clumping together of particles of an iron mineral precipitated from solution. With the passing of time the original mineral was altered to the hydrated iron oxide, limonite.

In South Africa there are pipes of platinum, tungsten, molybdenum, tin and zinc in the form of the ores of the metals. These are usually embedded in solid rock and cannot be isolated as individual sections.

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THE ELEPHANT TREE

Strange and somewhat rare dweller of our arid southwest

By JOHN THIEL

The wanderer in the southern part of the Colorado Desert of California, western Arizona, Lower California or Sonora, Mexico, may come upon a strange tree. It will be found growing on the rocky banks of washes, and its large branches, curiously twisted and interwoven, look like the coiled and upraised trunks of elephants. It is from such resemblance that this somewhat rare desert dweller gets its popular name of elephant tree. Asa Gray gave it the scientific name, *Bursera microphylla*. It is now generally called *Elaphrium*.

Growing in what seem most inhospitable surroundings, getting what moisture it can when the usually dry washes of the region carry their infrequent supply of water, this tree usually does not exceed fifteen feet in height. Its branch spread normally does not exceed twenty-five feet. One of its outstanding characteristics is the thickness of the trunk, in which it seems to make up for its lack of stature. The trunks reach a circumference of five feet, and branches are often a foot in thickness. The tree is somewhat aromatic.

The bark of the main trunk and of the larger branches is the color and texture of fine parchment. As it dries it curls back in thin, transparent layers. When the trunk is slightly injured it bleeds red—a red as rich as the color of red beets. This characteristic is carried out in the smaller branches, which are cherry red.

On the opposite page are shown the leaves and fruit on a branchlet of the tree. These are shown slightly less than natural size. The flowers are polygamous, have a small calyx, four to five lobed, and are quite persistent. The seed cones are about the size, color and shape of blueberries. When they are ripe they split into three valves, each with yellow seed. That these seeds are able to make a start in life is one of Nature's many marvels.

NON-SKID FEET

By ARTHUR H. FISHER

Nature's way of providing animals with equipment for life in their environment is an ever amazing source of interest. Grizzly bears, who never climb trees but grub for a large portion of their diet, are equipped with unusually long claws. Polar bears depend on speed and sure-footedness to win a living on the polar ice. They are streamlined, and, although with claws of normal length, the soles of their plantigrade feet are "rough-shod", particularly the surface beneath the heel, with a thick coat of hair, a characteristic entirely peculiar to their species. This hairy sole is not present in other species of bears (note the feet of the Kadiak bear here pictured), just as a moose is not equipped with the knife-like edge of hoof possessed by the caribou, which enables them to travel over a smooth frozen lake at high speed. This hair equipment on the feet of polar bears persists even after years of captivity.

★ Conservation ★

A part of Nature Magazine each month is devoted to the expression of practical opinions on the vital issues affecting our use and abuse of natural resources, including wildlife, and dedicated to the purpose of assisting Americans to play a militant part in the attainment of constructive conservation aims.

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MEET THE ★ INEVITABLE

There exists among humans a perennial disposition to postpone the inevitable. Complicated by expediency, this practice extends to politics and government. Legislation is often based upon this approach to a problem, and there is no better example than in the progress of the Federal Government thus far in meeting the menace of stream pollution. What does the record show?

Through the years industries, communities and individuals have been using the water courses of America as the easy dumping places for their wastes. Many of these wastes are poisonous to human beings and fatal to the aquatic life of the streams. To make the water relatively safe and wholesome for drinking, communities have installed treatment plants. By chemical processes the water is made adequate to satisfy thirst. Yet many of these same communities continue to dump their sewage into the stream, adding to the problem of the community farther down river. The burden has become too great. Much aquatic life has gone; the menace to human life increases.

What has been done? Federal, state and private agencies have conducted extensive studies to discover means of otherwise treating wastes, or, in some cases, converting them to products of economic value. The facts of pollution and its remedies are now known. Dangerous wastes can now, almost without exception, be eliminated without the necessity of sacrificing our streams by turning them into sewers.

Why, then, the delay? Polluting industries, important and powerful in our economic and political structure, do not wish to spend the money for elimination plants. Municipalities are satisfied to provide chemically pure water and to spend their money on other projects, more spectacular and politically popular than a sewage conversion plant would be. Both sources of pollution enjoy sufficient power to postpone the inevitable.

The strategy of polluters has been just this. Giving eloquent lip service to the vital need of pollution control, they have ardently supported legislation to investigate the problem. This procedure, they urge, should be followed instead of requiring by law that industry and community check their polluting activities. Voluntary cooperation, they contend, is the only proper course. Yet it is plain that ample opportunity for such cooperation has long existed under state laws, but the opportunity has only inadequately been seized. It has not and will not solve the problem.

There is pending before the House of Representatives of the present Congress, having already passed the Senate, the Barkley Bill. It is misnamed a pollution control measure. Actually it seeks to postpone the inevitable by providing funds for a decade of further study and investigation. This bill should be defeated. Its passage will delay rather than promote the solution of the pollution problem. It is a politically expedient subterfuge designed to lull the public into thinking that something effective is being done and to please powerful interests.

A wisely-drawn and moderate law, providing for enforcement of regulations that will clean up the situation, is what we must have. Such a law is presented in the Mundt Bill, re-introduced in revised and perfected form at the present session of Congress. This pure streams bill has the endorsement of the Izaak Walton League and many other conservation groups.

In some particulars the Mundt Bill is similar to the Barkley Bill. Both measures provide for jurisdiction over navigable waters; for cooperation with state agencies. Both authorize the formation of interstate compacts; both provide for official recognition of watersheds. The Mundt Bill differs from Senator Barkley's measure by providing for administration by the Chief of Engineers of the United States Army in cooperation with an advisory committee from the U. S. Public Health Service, the Biological Survey and the Bureau of Fisheries. The Barkley Bill vests administration in the U. S. Public Health Service, which has consistently shown a disinclination to administer and enforce legislation. The Mundt Bill authorizes up to $250,000 annually for administration; the Barkley Bill

$1,000,000 of which $300,000 is for administration and the rest for "further study and investigation."

Under the terms of the Mundt Bill authorization is given to setting standards of purity, minimum treatment of wastes, and regulations governing discharge of wastes without summarily ordering elimination of all pollution. The Barkley Bill makes no such provisions.

The Mundt Bill provides for extensions of time for compliance with the law that are completely fair and liberal. The Barkley Bill, providing for no enforcement at all, is silent on this. The former measure recognizes and accepts all existing pollution control authorities; the latter, again because it is toothless, does not cover this point.

Pollution of navigable streams, which are of great concern to the Army, is a Federal matter. Most of these streams are interstate. The need, then, is for a Federal law that is fair, but which will meet the inevitable instead of postponing it. Such a law may be placed upon the statute books by the enactment of the Mundt Pure Streams Bill. It should be passed.

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TO THE ★ ★ BOY SCOUTS

Thirty, at the end of a newspaper reporter's story, means the end. Thirty, to the members of the Boy Scouts of America, means a birthday and the beginning of a new decade of service to America and to American youth.

On February the eighth, 1910, the Boy Scouts of America was incorporated under the laws of the District of Columbia. There was then begun a movement with which more than 8,700,000 persons in this country are or have been identified. With an active membership of 61,495 at the close of 1911, the Boy Scout membership has grown steadily through the years to a roster of 1,271,900 in 1938.

Figures may be spectacular, as indeed they are in any statistical review of Boy Scout accomplishment, but they are meager when compared with the contribution that this movement has made to Americans in ideals, manliness and in service both to the community and to its rising generations.

On this thirtieth birthday we salute the Boy Scouts of America. We wish for them decade upon decade of greater service in a country where youth may enjoy freedom of thought, speech and action. We are fortunate to have the Boy Scouts, and they, in turn, are fortunate to be Americans. Their responsibilities will be great in the years to come and they may well be prepared.

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WILDLIFE MEETINGS

Conservation of wildlife will provide the subject matter for two important meetings in March. From March 17 to 23 the third annual National Wildlife Restoration Week will be observed throughout the United States. Appropriately the Fifth Annual Wildlife Conference will be held in Washington, D. C., from March 18 to 20.

On the heels of the Washington meeting, the members of the Izaak Walton League of America will gather in Chicago from March 28 to 30 for their annual meeting. On the agenda for that gathering will be consideration of the pollution problem; the need of protecting our rivers and streams from abuses in utilitarian development that ignores the public's right in existing and potential aquatic values; the increasing public demand for the protection of wilderness areas against roads and other encroachments of civilization that destroy them.

The Wildlife Conference in Washington will be sponsored jointly by the American Wildlife Institute and the National Wildlife Federation. The plan of the meeting will vary from that of previous meetings, with general sessions in the morning and technical sessions in the afternoon. The Wildlife Society will meet at the same time.

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ELEPHANT SEAL ★ ★ ★

A huge, odd-looking creature washed ashore on the beach of Prince of Wales Island, in the Tongass National Forest, Alaska, last November. According to U. S. Forest Service rangers who reported the discovery, it was an elephant seal, *Mirounga angustirostris*. The discovery of this animal in Alaskan waters is of particular interest to scientists because it has never been recorded north of California.

Elephant seals used to be quite common off the coast of southern and Lower California where small herds could be found on the islands and more inaccessible beaches of the mainland. But whalers and sealers soon found that these animals could be easily killed, and the large amount of oil in the seals' bodies made it profitable for the sealers to slaughter them. From 1855 to 1870 great numbers of these animals were killed. By 1892 only nine elephant seals could be found on Guadalupe Island and seven of these were pursued and killed. Fifteen years later fourteen in a herd of forty were killed on this same island. The slaughter of these helpless animals was stopped, and in 1929 a count revealed four hundred and sixty-nine individuals in the Guadalupe Island herd.

The elephant seal is the largest member of the seal family. The males sometimes reach a length of twenty-two feet and a weight of nearly three tons. The elephant seal, or sea elephant as it is often called, gets its name from the curious flexible snout of the males. This snout hangs six to ten inches below the muzzle when relaxed and like the trunk of an elephant can be moved about.

Little is known of its food habits, but the stomach contents of one found off Point Loma, San Diego, California, in 1929, indicated that these slow moving seals feed mostly on the bottom in three hundred to nine hundred feet of water. Their food consists mainly of squids, skates, ratfish, and a slow moving species of shark.

The only two known enemies of the elephant seal are man and the killer whale. According to the Forest Service, the fifteen foot, three thousand pound specimen found at Kasaan, Alaska, had an immense scar on its left side where a large piece of flesh had been torn out, evidence of an encounter with a formidable enemy.

"EVERY FEW FEET LATERAL GULLIES WERE STRETCHING THEIR GREEDY FINGERS INTO THE VALLEY AND CRUMBLING THE LAND BETWEEN THEM"

The Tragedy of the San Simon

By HENRY H. COLLINS, JR.

In northern Arizona one of the great wonders of the world, the Grand Canyon of the Colorado River, shows the gigantic erosive power of time and water. In southern Arizona the San Simon Wash shows the far greater erosive power of water and man. At the rate of an inch every 400 years the Colorado, it is said, required 30,000,000 years to cut 6200 feet to its present level. But since its birth, 54 years ago, the San Simon has cut, at more than 1700 times the rate of the Colorado, a depth of more than twenty feet, and created, virtually from nothing, a channel more than a hundred miles long.

Twenty-five miles in width, eighty in length, guarded by ridges from 5000 to 10,000 feet in height, the million and a quarter acres in the San Simon Valley and on its mountain flanks would seem to make an ideal site for a home on the western range. Even in Spanish times haciendados of note are said to have located in this generous basin. Reports from those dim days state that livestock abounded on the plantations and overran the valleys and uplands, but in numbers, apparently, insufficient to disturb the age-long balance between vegetation and soil. When military protection was withdrawn from this remote province after Mexican independence in 1822, Apache raids soon discouraged ranchers and the valley reverted to its primitive condition.

Barely 90 years ago the first American reference to this famous watershed seems to have been made by Lieutenant Emory while making a reconnaissance in 1846 during the Mexican War. Travelling with a party trained in geology, botany and zoology, he noticed a creek emerging from the valley to the southeast and entering the Gila River near the site of the present Solomonville. But it was so insignificant he did not mark it on his map. According to Ross Calvin, a recent student of the region, this stream was known in 1850 as the Rio Santo Domingo.

In 1854 John Russell Bartlett, Commissioner of the U. S. Mexican Boundary Survey, also saw this San Simon region in its unravished beauty. Descending from the Peloncillo Mountains eight or ten miles into the plain unbroken by hill or tree, his party reached El Sauce, The Willow Marsh, where the drainage collected from the mountains that flanked this vast basin. "Here was a great abundance of water which, from the rushes that grew on its margin, I suppose to be permanent. Grass was also plenty here."

Samuel W. Cozzens five years later confirmed Bartlett's description and elaborated on the nutritious quality of the grama. This grass, abundant in the San Simon district, he discovered to be equal to grain in food value, and observed that in spring stock that had fed on it through the winter were in as good condition as stall-fed animals.

In 1875 surveyors for the General Land Office still found Emory's creek too insignificant to place on their first map of the region. Will C. Barnes, a prospective stockman, estimated that the valley in 1882 contained 750,000 acres of grazing land. Barring the disappearance of the willows it was still in its pristine condition. He found beautiful grassy meadows in its lower course and an intermittent stream above. Antelope and deer still quenched their thirst at its bankless brink and found their

way to and from the water through lush meadows of fine stock grasses and colorful wild flowers. Where the stream flowed into the Gila its banks were scarcely three feet high and its bed but twenty feet wide. This is the last report that we have of the original San Simon. Here begins the descent to Avernus.

Erosion, aided by four tragic events (two acts of man and two acts of God), during the next fifty years completely ruined the use and fertility of this mighty valley. In a short half century it drained away the water reserves of a thousand years and washed away soil deposits accumulated over 50,000 years. Compared, or rather contrasted, with erosion in the East the destruction in this part of the West has been both more spectacular and more stupendous. Farmers have required generations to devastate limited areas in humid regions, where vegetation is quick to close the scars of a wounded land. But in the arid West the balance of Nature is more delicately hung. There a handful of cattlemen and sheepmen have irreparably ruined counties as large as whole Eastern states within the memory of men who are not yet old. In the San Simon Valley fewer persons in a shorter time imposed on a vaster area greater destruction than the United States had as yet seen. The four horsemen of this Arizona apocalypse were overgrazing and drought, a ditch and a flood.

The first of these grim riders chose a Texas steer as his mount, for this corner of southeastern Arizona was on the main cattle road between the Lone Star State and the West. Following the suppression of the Apaches in the early 80's endless herds of longhorns grazed their way westward through this fertile valley. Laws governing the public domain offered every inducement for each rancher to bring in as many cattle as he was able, and to let them eat up as much grass as they could, within the shortest possible time. Occupation conferred the rights, but not the duties, of possession; and on the unfenced plain deferred grazing would have been an invitation to others to fatten their cattle at the first-comer's expense. Grazing on the domain was completely unrestricted. Ranchers saw that the fine grass would not last forever, and competition forced each to exploit as great an area of land as quickly as he could. Serious inroads into these luxuriant pastures had already been made, and the ranges were stocked to capacity by 1891.

In that year the second horseman, drought, rode into the blue sky of Arizona. The new crop of grass was a failure, but the calf crop was the largest on record. A year passed and 1892 arrived with drought and famine still riding the cloudless sky. The usual summer rains did not come, and by August cattle were perishing everywhere. One rancher said he could walk for miles along the Upper Gila stepping on the bodies of his dead or dying cows. Still no rain fell. The seasons dragged on, but the new year brought no relief. During May, June and July of 1893 the worst losses of all occurred. Before the drought was broken the destruction of cattle was estimated at not less than fifty and possibly as high as seventy-five percent.

The century-old reserves of soil fertility, however, were not yet exhausted and 50,000 cattle were still grazing the San Simon ranges in 1895, a year when the tax rolls already showed a 35 per cent reduction in the state cattle totals from the 1891 peak.

The third horseman was the driver of the first team that started excavating the ditch from the Montezuma Canal to the Gila. Since Indian days the summer rains, flowing evenly over the flat valley, had spread out and flooded the lands near the entrance to the river. This distressed the settlers at Solomonville, a village near the junction of the Gila and the San Simon. To avert this, in 1883, according to some authorities, but in 1899, according to Solomonville's weekly, *The Arizona Citizen,* the settlers decided to dig a ditch that would carry off the water in the rainy season and eliminate floods. So they dug a ditch (presumably along the former Rio Santo Domingo; but the thrifty diggers took care to run the channel along a section line) four feet deep and twenty feet wide and a mile and a half long. And they built funneling levees to assist it.

The ditch worked and it worked well. In 1916 the United States Congress commissioned Frank H. Olmstead to develop methods for the control of floods caused by erosion in the watershed of the Upper Gila. He found that in one generation the San Simon ditch had already become a vast chasm; it had grown in depth to twenty

feet, in width to 800, and in length it had increased to the unbelievable distance of sixty miles. Precipitation from the mountains surrounding the valley, as well as from the plain itself, was now largely wasted. Instead of spreading its runoff over a width of 20,000 feet or more, moving slowly down the valley and recharging the underground and artesian water supply, rain-water now rushed through gullies from the mountain canyons to the valley wash, and carrying off immense quantities of soil, silt and potential underground water, added the turbid flow of the San Simon to that of the Gila.

Olmstead's report to the Senate, which included recommendations for controlling the floods and erosion, was allowed to age in silence. In 1920 his son, Harry F. Olmstead, notified the business and farming interests of the valley that it would cost $15,000,000 to capture and use effectively the flood waters of the San Simon over 250,000 acres.

The fourth and final horseman charged down the waves of the San Simon on the crest of a mighty flood. In 1905 a spring inundation (of a violence that might be expected only once in a hundred years) so enlarged the tributaries and the channel of the wash, and carried away such quantities of silt and underground water, as to prepare the valley for its virtually complete destruction.

Thirty years passed and in 1934 the Soil Conservation Service commissioned B. P. Fleming and Floyd D. Mathews to make a new survey. They found so accelerated a degree of erosion that if uncontrolled it threatened to scour completely in another fifty years the age-long silt deposits from a valley one to three miles in width and 100 miles long.

Mathews remarked that the biggest ranchers had skimmed the cream and were moving out even by the turn of the century. Then came small homesteaders who hoped to make a living by combining cattle raising and dry farming, the latter supplemented by artesian and underground water. But the scarcity of rainfall, and overgrazing, the advancing gullies of the wash, and the subtraction of the underground water, so discouraged settlement that by the early 20's most of the homesteaders had left. Mathews found the region an abomination of desolation, and he thus placed the blame:

"If this were a condition which Nature itself had initiated and if the demonstration of erosive action at work in the San Simon and its tributaries were matters as to which man might disclaim all responsibility, he might feel easier about it even though its consequences were equally menacing to the civilization he had so painfully built up in these desert regions. But man is responsible. He cannot evade the issue. He made the dikes and the ditches which started erosion of the original channel of the San Simon. His cattle made trails through the valley which the storm waters followed and eroded. His freight wagons wore deep furrows in the valley floor which later became water courses. His cattle and goats denuded the adjoining ranges of grasses and other vegetation and rains scoured the surface soil from the steeper slopes."

The 1936 report of Hugh G. Calkins, Southwest Regional Conservator for the Soil Conservation Service, terminates the historical record and completes the picture of devastation. Despite the ravages of erosion he found practically the entire area still grazed by livestock and still heavily overstocked, yet over much of the desert-like parts of the range it would have taken more than two sections of land (1280 acres) to support adequately one cow for a year. The majority of the proprietors were now absentee owners. Both forage and water resources fell far short of the demand; and, threatening the survival of irrigated lands along the Lower Gila, he found the annual contributions of the San Simon Valley to the San Carlos Reservoir, which already contained 40,000 acre feet of sediment, were only 3 per cent of the water but 24 per cent of the silt. He concluded with the gloomy observation that, although drastic reductions of herds would be necessary, it was doubtful whether the watershed ever could be stabilized.

The only water flowing in the entire San Simon Wash when the author visited it in April, 1937, was in the half mile above its junction with the Gila River; and this did not come from the San Simon itself but was leakage from irrigation ditches nearby, supplied by the Gila a few miles above. The channel, diked, here flowed through cultivated

"THE STREAMBED WAS COMPLETELY DRY, EXCEPT FOR OCCASIONAL ALKALI-COATED STRETCHES OF QUAGMIRE"

fields, but the twenty-foot outlet of 1883 was now seventy-five feet wide.

In this short course water made green the new leaves of a few bordering cottonwoods in which a flock of doves and an oriole sought refuge from a hawk. From the banks kingbirds and vermilion flycatchers sallied after insects attracted by the water. Along the moist wash killdeer and spotted sandpipers gave their calls as of old, and a flock of least sandpipers in migration wheeled up and down the short stretch, as a century ago they might have wheeled anywhere in the hundred-mile valley.

Upstream, as the grade increased, the wash gradually deepened its bed and greatly widened its bank. Sixteen miles south was the little railroad station of Tanque, its name, perhaps, a memorial to those early Mexicans who found, or constructed there, a watering place for their stock. The wash at this point commenced to assume its most rugged and forbidding character. Walls of precipitous earth twenty feet high formed its banks for mile after winding mile. The bed of the stream itself had broadened to more than a hundred yards. Because of the soft sides and the gentle grade, the river when in flood had created a channel of meanders. In the short sections between bends the river narrowed, only to widen out at the curves where the full force of the water had undercut each concave bank. In addition, every few feet along both sides of the wash lateral gullies were stretching their greedy fingers into the valley and crumbling the land between them.

Everywhere projecting from the banks could be seen the roots of plants luckless enough to have sought security on this vanishing ground. One hundred and fifty yards to the west of the wash and three hundred yards to the east the plain had been so riddled with gullies as to be worthless. These distances, together with the breadth and the meanders of the channel itself, indicated that for a width of probably half a mile the center of this valley had been irrevocably destroyed.

What a change from the water-filled course at the outlet! Here, instead, the streambed was completely dry, except for occasional alkali-coated stretches of quagmire, treacherous remnants of disappearing moisture. In place of great cottonwoods the inner borders of the wash supported, where they supported anything, an occasional growth of the imported tamarisk. The tops of the caving banks, due to the undercutting and drainage of ground water, were devoid of vegetation. Farther back intermittent growths of browse and a few annual plants had replaced the luxuriant grasses of old. The birds were different and rarer. From the banks an occasional desert sparrow fluttered away; over the dry streambed floated the shadow of a red-tailed hawk, and the silence of the waste was broken only by the solitary croak of an occasional raven.

A forsaken road straggled southward through the basin. For stretches of hundreds of yards its tracks crossed the gravels of flood-time tributaries. Sometimes it climbed along a stonier elevation covered with greasewood, from which slight eminence miles of desolation could be viewed. Nothing broke this vast sea of green-gray poverty but a few wandering cattle and one distant ranch windmill. The hardy, or discouraged, occupiers of this lonely outpost expected little traffic, or feared it less, for the single road through the valley, blocked by two gates, traversed their back yard. And as might be imagined, their house now looked down on a tributary gully three feet deep and sixty yards wide.

Fifty miles from its mouth the San Simon Wash is crossed by the Lordsburg highway cut-off near the town of San Simon itself. At this point the wash was still of formidable dimensions, fifteen feet deep and thirty-five yards wide. Two hundred yards farther upstream it had put the Southern Pacific Railroad in 1926 to the expense of a new bridge on its main line to the coast.

Another twenty-five miles upstream the Broadway of America, U. S. Route No. 80, emerges from a pass in the Peloncillo Mountains (possibly the same one that Bartlett took in 1854) to cross the upper end of the San Simon Valley. Here, seventy-five miles from its mouth as the crow flies, and a hundred as the river meanders, three bridges were required to carry the road over the headwaters of this infamous creek; and each of these crossed a channel deeper than the four feet, and wider than the twenty, of the original ditch cut into the Gila.

In the fifty-seven years since that ill-fated day in 1883 the vegetation of the valley has changed from luxuriant grasses to the sparse browse of the present. The succulent

"THE ADVANCE OF THE GULLY IS SLOWED WHERE THE GRASS, AS IN THIS ISOLATED INSTANCE, IS PROTECTED FROM OVER-GRAZING"

gramas have given way to squawbush and snakeweed, the cottonwoods to creosote and cactus. As the plants have altered so have the mammals, for fauna changes with every tilt in the balance of Nature. Where coyote once preyed on cottontail rabbits, now kangaroo rats and jack rabbits, with the decline of their hereditary enemies, greatly increase both their numbers and their depredations. Where 50,000 cattle grazed and overgrazed the land in 1895, 15,000 do so today, and were their numbers reduced to the recommendations of the Soil Conservation Service less than 9000 would remain. Erosion here has already completely destroyed more than 22,000 acres of once productive range and agricultural land, and is continuing at the rate of a thousand acres a year the damage that by 1920 had already been estimated at over $15,000,000.

The land ownership pattern of small individual patents scattered amid larger acreages still reflects the shattered hopes of those agriculturists who visioned independence in dry farming, and of those ranchers, large and small, whose intensive grazing hastened the land's decay. The population has scattered and decreased. The few towns remaining exist largely on resources other than the yield of the land. Solomonville, to be sure, is agricultural, but on fields irrigated by water from the Upper Gila. Tanque owes its continued life to the watering needs of steam locomotives. Rodeo and San Simon eke out a dusty existence administering gas or oil to motor vehicles crossing the now barren wastes of the valley on their way to the Pacific; and the fortunes of Bowie, a railway junction, flourish or decline with those of the Southern Pacific.

There is mockery to be found in the words of "Home on the Range", when we look at many parts of the West today. Even though few buffalo may ever have roamed the San Simon, the contrast between then and now is of broad application.

"Oh, give me a home, where the buffalo roam,
And the deer and the antelope play,
Where never is heard a discouraging word,
And the sky is not cloudy all day."

The antelope, mentioned by Barnes, ekes out a prescribed existence on a few distant reserves. The once ubiquitous deer is now found mainly in the mountains. From the sky, it is true, rain falls as infrequently as ever, and its brilliant blue is seldom obscured by life-giving storm clouds. But what of the clouds of dust that darken sun and sky, hide distant mountains and nearer fields, and cover man and his possessions with their fine and filthy films. Alas, discouraging words now frequently are heard.

"Oh, give me a land, where the bright diamond sand,
Flows leisurely down the clear stream,
Where the graceful white swan glides slowly along
Like a maid in a heavenly dream."

Over what land does the bright diamond sand now flow leisurely down the clear stream? Not over the valley of the San Simon. Here, to the bright diamond sand, have been added silt, mud and gravel in turbid and destructive confusion. The leisurely flow has given place to long months of aridity and short hours of extreme violence. The clear stream is now never clear, and in fact seldom even a stream. It deserves the title of "muddiest river on earth" more than does the Gila. Even the graceful trumpeter swan once breeding over much of our West now finds in the Yellowstone region a precarious refuge from the restless firearms of the paleface. Indeed, all that is left of a home on the San Simon range is the vision of the maid in a heavenly dream; and she is scarcely more of a phantom than are the soil and fertility of this ruined valley where once the "grass was plenty" everywhere.

HIGHWAYS

By OSCAR OSTLUND

Easy roads, into a refuge of the loon,
They are too much with us, late, or soon.

Such highways bring a harsh cacophony,
Discord into a natural symphony.

By swarms of motor cars, misplaced;
Primeval beauty is defaced;

Its florid features soon turn pale,
Where stands distribute cakes and ale.

Things to Think About

As soon as the hunting season was in full swing, reports the Canadian Resources Bulletin, there was a marked increase in the number of wild ducks in Prince Edward Island National Park, according to the report of the superintendent. The park is an absolute wildlife sanctuary and the birds soon learned about it.

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Fifteen and a half million people visited the various units of the National Park system during the travel year ending September 30, 1939. Seventeen of the twenty-five National Parks reported increases in visitors.

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Under the newly-established Biological Institute of the University of New Hampshire at Durham a biological survey of the state will be undertaken. Floral, faunal and mineral sources will be included in the study.

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Travelling more than eight hundred miles in two trucks, twenty-three Rocky Mountain bighorn sheep have been released on the Hart Mountain Antelope Refuge, Klamath Falls, Oregon. These newcomers, from the National Bison Range in Montana, will swell the refuge's bighorn population to fifty-three. Bighorns were once abundant in this part of Oregon.

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A new device—or a variation of an old one—is being employed by the Donnelly Advertising Company, the largest billboard concern in New England, to strengthen its defense against opposition to the rural billboard. Associations, chambers of commerce and local merchants are asked to endorse billboard advertising. If they do so, and sign contracts for space on two boards, they are given free a third billboard showing. An example of the reaction to such a proposal is found in Augusta, Maine, where the Chamber of Commerce was thus approached. The Kennebec Valley Garden Club reaffirmed its intention to patronize only firms that do not advertise on the landscape, and the contracts were not signed. Other organizations and individual merchants have, however, fallen into the trap and thus incurred the ill will of an important part of the buying public.

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"With Canada at war, Jack Miner has got to depend on his United States friends as never before for financial aid in maintaining his conservation activities at Kingsville, Ontario." So reads a notice, printed in red, that accompanies a folder descriptive of Jack Miner's work. Thus does war affect wildlife in one instance. If you are not acquainted with the work he has been doing, would like to know more about it, and, possibly, help out, write to Jack Miner, Kingsville, Ontario, Canada, for a copy of the descriptive folder.

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Definite activity toward the introduction of conservation as a course of study in the public schools of Minnesota is now going on. The State Board of Education voted to cooperate with the State Department of Conservation in preparing a conservation study course booklet for public school teachers. Dr. George W. Friederich, former chairman of the State Conservation Commission and a member of the faculty of the St. Cloud State Teachers College, has taken on the task of writing the booklet, which will be published jointly by the two departments.

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Tabulation of figures by the United States Bureau of Fisheries indicates an increase of a half million in the number of anglers paying State license fees during 1939. A total of 7,436,177 such licenses were issued, and 5,453,425 of these were for fishing alone, the balance being combination hunting, fishing and trapping licenses. The Bureau estimates that if salt water fishermen, who do not have to have licenses, were included, the devotees of the rod and reel would number more than twelve millions.

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According to an article by Don Herold in *Better Homes and Gardens* for December, 1939, *Nature Magazine* recently offered $5000 for a live passenger pigeon. To this effect, Mr. Herold quotes Waldo E. Sexton who, with Arthur G. McKee, has established the McKee Jungle Gardens near Vero Beach, Florida. While we would have no fear of having to pay out this rather important amount of money for a live passenger pigeon, we feel that we should make it a matter of record that we have never made such an offer. Our recollection is that a comparable offer for the discovery of a nesting pair was made by a gentleman in New England some years ago, and that this proposal provided the idea germ for a recent novel by McKinlay Kantor entitled *The Noise of Their Wings.*

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C. M. Palmer, Jr. has been appointed secretary of the American Wildlife Institute, of which he has been assistant and acting secretary consecutively since the formation of the Institute. Mr. Palmer was formerly associated with the American Game Association, and has been identified with sportsman-conservation work for many years.

Animals Do Not Spare the Rod

Some notes on correction in the wild

By W. L. McATEE

Cartoons by Russell O. Berg

CORRECTING, not to use the old-fashioned term, spanking, as applied to the sons and daughters of men, is under the ban of a modern school of thought. In all likelihood the devoted efforts of these humanitarians have produced the deplorable rise in juvenile delinquency that we are now experiencing. It is a satisfaction to report, therefore, that in the natural world, the time-honored custom of drubbing, flailing, whaling—beg pardon, correcting—still prevails, to the end that progeny shall grow up to be at least as well behaved as the parents.

Among the animals the expression "Now this is for your own good" would be as appropriate as it is in connection with human discipline, and although true, is no doubt just as hard for the spankee to understand. Chastisement undoubtedly for the youngster's welfare has been reported for the white-tailed deer and for a wild strain of the domesticated goat.

"One summer evening," W. H. Britton writes of the deer, in *Pennsylvania Game News,* August, 1937, "I witnessed a doe deer in the act of correcting her youngster. The little fellow was insistent upon emerging from the cover of the forest to get onto an open patch of green, where its mother had come to graze. It was so disobedient that she took it to the edge of the forest where there was fern and other undergrowth and tapped it with her front foot somewhere near the head or neck, whereupon it lay down and stayed put until she had finished eating. Then with a muffled baa she beckoned to her charge, which immediately came onto the green for a romp. Now she could devote all her attention to the safety and welfare of her babe."

Describing travel of the goats in the mountains of Scotland, Hugh B. Watt says in the May, 1937, *Journal of Animal Ecology* that "the nannies sent their kids in front of them through the worst of the rocks. If the kid takes a step in the wrong direction it gets a dunt from its mother's horns as correction."

These taps, these dunts, so necessary in guiding the babes aright, do not impair their happiness, for they romp with all their might at every opportunity. No children of the wild are more frolicsome than bear cubs, yet upon occasion these little fellows have to take a rap. J. Paul Miller tells me that once when he was resting beside a trout stream in western mountains, a black bear with two cubs came in sight, and, after following the bank for a short distance, the mother chose a place where some stepping stones made it easy to get across. She came over and was followed by one of the cubs. The other hung back, and ran aimlessly about on the slope they had just descended. The mother returned, and gave the cub a wallop with her paw that sent it rolling. She then recrossed the brook and the previously hesitant cub came along without further foolishness.

These observations were in the wild where, for the sake of true knowledge of Nature, it is best to make them. One relating to captive animals is of such interest, however, that it seems worth relating. A tigress with her four cubs once was on exhibit at the National Zoological

Park in Washington. At the time we saw them the tiger-lets were busily playing with each other, but that was not enough to satisfy one of them, who kept pawing his mother about the face. She evaded these passes for a time, but, the youngster persisting, she finally took his whole head in her mouth and gave it a squeeze. The cub whimpered and when released was glad to go back to his sibs and leave mamma in peace.

Upon occasion, birds also find it necessary to chastise the young. Some years ago in the Smithsonian Park, hearing a robin crying murder, we reached the scene as soon as possible, and saw a mother robin standing over a fledgling as large as herself, fairly smothering it in a flurry of wing strokes. We did not know what the trouble was but she was whacking him good, and he was yelling for dear life. The incident was quickly over and quiet reigned again in the robin world.

In all of these instances animal mothers attended to the correcting. This suggests that human mothers should take full charge of discipline instead of, as is so often the practice, referring it to papa. The latter is likely to be either too hard or too soft. What is needed is temperate and just, but sufficient and effective, correction. Humans should always realize that they are part of Nature and that they are usually well advised in following Nature's methods, which have had the advantage of long trial.

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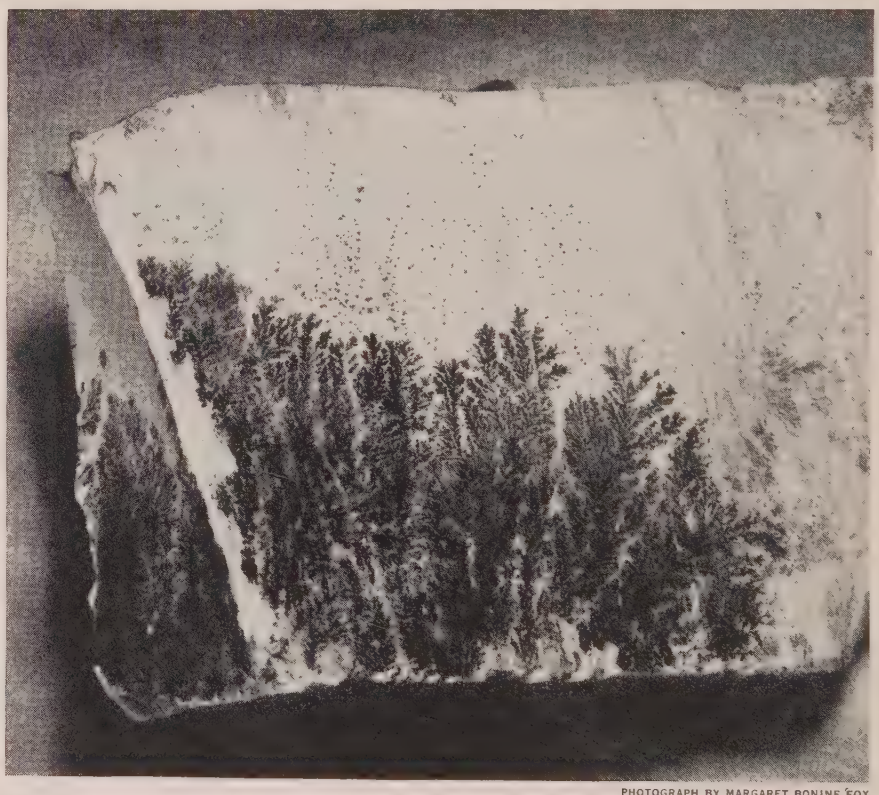
Water and Dendrites

By C. S. GWYNNE



PHOTOGRAPH BY MARGARET BONINE FOX

THE ARTISTRY OF UNDERGROUND WATER

Dendrites painted by seeping water on rocks upon which it leaves mineral matter. The specimen here is about twice natural size

HAVE you ever seen the gem stone called a moss agate? If you have, you have also seen at the same time something that looks rather like the marking on the stone shown here. This dendrite, as it is called, looks a bit like the picture of a tree branch, or of a spreading root. The term dendrite is given to it because of this branching characteristic.

Other dendrites, like the one in our picture, are on the surfaces of rocks, such as pieces of limestone. They are delicate, almost like pencil marks, and disappear slowly if the stone is left out in the wind and weather. For this reason, they are most likely to be found on freshly broken stone. Angular pieces of rock, weathered or broken and recently fallen from a cliff, may show them. So may freshly broken rock in a limestone quarry.

These "pencil marks" have been made by an obscure artist, underground water that contains mineral matter in solution. This water fell first as rain on the earth's surface and then seeped through the subsoil into the solid rock below. It collected mineral matter in its contact with the earth. It penetrated even the narrowest and tightest of cracks. In its movement along the cracks it deposited part of its content of mineral matter as compounds of iron, and of another element called manganese. In some places this deposit took the peculiar form of these dendrites. The dendrites are dark brown or even black, since this is the color of oxides of iron and manganese, of which they are composed. Some people think that the underground water, with its dendrites, is a better artist than Jack Frost with his window paintings of ice. But because this artistry is often passed unnoticed or not understood, this more obscure Nature artist is not acclaimed.

A North Woods Nature Museum

By LOUISE H. AND E. T. TONESS

Photographs by Thomas Faragher

AURORA, MINNESOTA, has a population of less than 1500. Yet it has housed in its high school a natural history museum that towns many times its size would be unable to equal. Here not only visitors from afar, but even many a local resident, may have his eyes opened to an unexpected variety of northwoods life, present and past—birds, mammals, fishes, insects, flowering plants, fossils—represented by many hundreds of mounted specimens and plaster impressions. Nearly all exhibits are of local origin, an exception being a case of tropical moths and butterflies, a gift from a mining engineer of the vicinity.

Aurora schools have found the museum a valuable teaching aid. The biology department has borrowed specimens for class work, and has conducted lectures in the museum. The curator has lectured on Nature study to many classes in the school. Even classes from neighboring towns come to the museum on Nature study field trips. Boy Scouts, especially when aspiring to the bird study merit badge, have discovered the museum to be of gratifying assistance in preparing them for their examinations.

Particularly impressive to one entering the museum for the first time are the life-like mounts of birds, most of these taken within a few miles of Aurora. Some of the most interesting are a turkey vulture, a golden eagle, ring-necked pheasants, various ducks, and ruffed grouse in natural habitat background. The spirit of the vulture is perfectly portrayed in the specimen, its hunched back, long red neck, and red head with beady eyes seeming to be ghoulishly awaiting the death of some hapless creature below. In addition to these there are about two hundred and fifty smaller birds, from common sparrows to the locally rare cardinal. About fifty mounts of birds are in process of preparation to round out the ornithological collection.

THE TAXIDERMIST AT WORK

A duck is being prepared for exhibit in the museum that has proved of such educational value to many

Among the larger mammals are a black bear, two deer, and a bobcat. There are several animal skeletons, representing forms as diverse as a large turtle and a huge moose.

Parenthetically, one might suggest that other schools acquiring museum collections should avoid the destruction of living birds and mammals for specimen material, by substituting artificial models, or by salvaging specimens. Our wildlife cannot stand many more drains on its numbers. Occasionally good skeletal material may be obtained from animals found dead, as was the above-mentioned moose. Excellent sources of specimens are the birds and mammals killed along the highways by automobiles. These can and should be salvaged oftener for educational purposes, such as this excellent collection.

Specimens of fish are treated differently from other specimens in the museum. The skins are not mounted, but plaster casts are made and painted. The results appear so natural that it is impossible to detect that they are not stuffed fish.

Between two and three thousand insects are neatly mounted in twenty-four glass-covered cases. They include the museum's only display of specimens that are not found locally—a case of tropical Lepidoptera. The great wing spreads and the iridescent blues and other brilliant coloration of some of the latter place them in sharp contrast to their smaller and usually duller northern relatives.

MOUNTED SPECIMEN OF BOBCAT

With the exception of one display of Lepidoptera, the exhibits include only the local flora and fauna

Reminders of an age and a climate far different from that of present-day northern Minnesota, where winter temperatures of −35°, and lower, are common, reside in the museum's two cases of fossils found in iron ore mined in the district. Fragments of fossilized palm trees and of other tropical plants, believed to be bamboo, lie near a collection of fossil oysters, several ichthyosaur vertebrae from the Cretaceous period, and even a collection of shark's teeth—found on the Iron Range on which Aurora is located, 1300 miles from the nearest ocean! Of all fossils displayed here, the most spectacular is the natural casting of an ammonite, appearing to be an oversized snail shell fashioned from iron ore. It is declared to be one of the finest castings of Minnesota species shown anywhere. The whole display furnishes evidence that Minnesota was at one time covered by a tropical ocean dotted with jungle-covered islands.

The registration book shows that the museum has had visitors from points as far away as Houston, Texas, and Seattle, Washington, in the United States, and one from Vienna, Austria. On one line in the "remarks" column of the registration book, in foreign-looking handwriting, were noted the Finnish words for "very interesting". But the museum probably serves its greatest usefulness not as an interesting curiosity to the casual visitor, but as an educational device for the school and the community. It has been used considerably in teaching conservation. In his lectures the curator has stressed the need for safeguarding the animal and plant life of our forests.

The establishing of the museum was inspired by the local superintendent of schools, Dr. C. E. Hagie, in April, 1936. To Robert S. Butsch, curator from March, 1937, until June, 1938, when he left for a position in the West Indies, is given credit for important improvements in mounting and displaying specimens. At present six people are carrying on the work: a clerk, an entomologist, a taxidermist and his assistant, a field man, and a cabinet-maker. The museum is a school-sponsored WPA project.

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Polynesia's Coconut

By EDITH M. LAING

WHEN I was a child in the South Pacific we commonly referred to our heads as "coconuts". And why not, when one considers the Polynesian legend about the origin of the coconut? It seems that Tuna, beloved of Hina, ordered her, in case of his death, to cut off his head and bury it. From it would spring a tree. The fruit of this magic tree, beside providing her with nourishment, would bear three distinctive marks: two representing Tuna's eyes, which had admired her beauty, and one representing his mouth, which had praised her. Accordingly, when Tuna was slain by a rival, Hina buried his head, and behold—the first coconut palm.

However, the imaginative but unpoetic European scientists noted the three marks on the base of the nut shell, thought of a monkey face, and named the palm *cocos,* from *coco,* the Portuguese word for monkey.

The *Cocos nucifera,* which grows so prolifically on tropical islands, was originally carried into the Pacific from the Indo-Malayan archipelago by ocean currents, and by colonizers in voyaging canoes. It is of the greatest economic value to the islanders, providing food, drink, oil, clothing, and building material.

Perhaps one of its greatest assets is in being one of the few plants that will thrive on coral-formed atolls. The luxuriant growth that we usually associate with all tropical islands occurs only on those of volcanic origin.

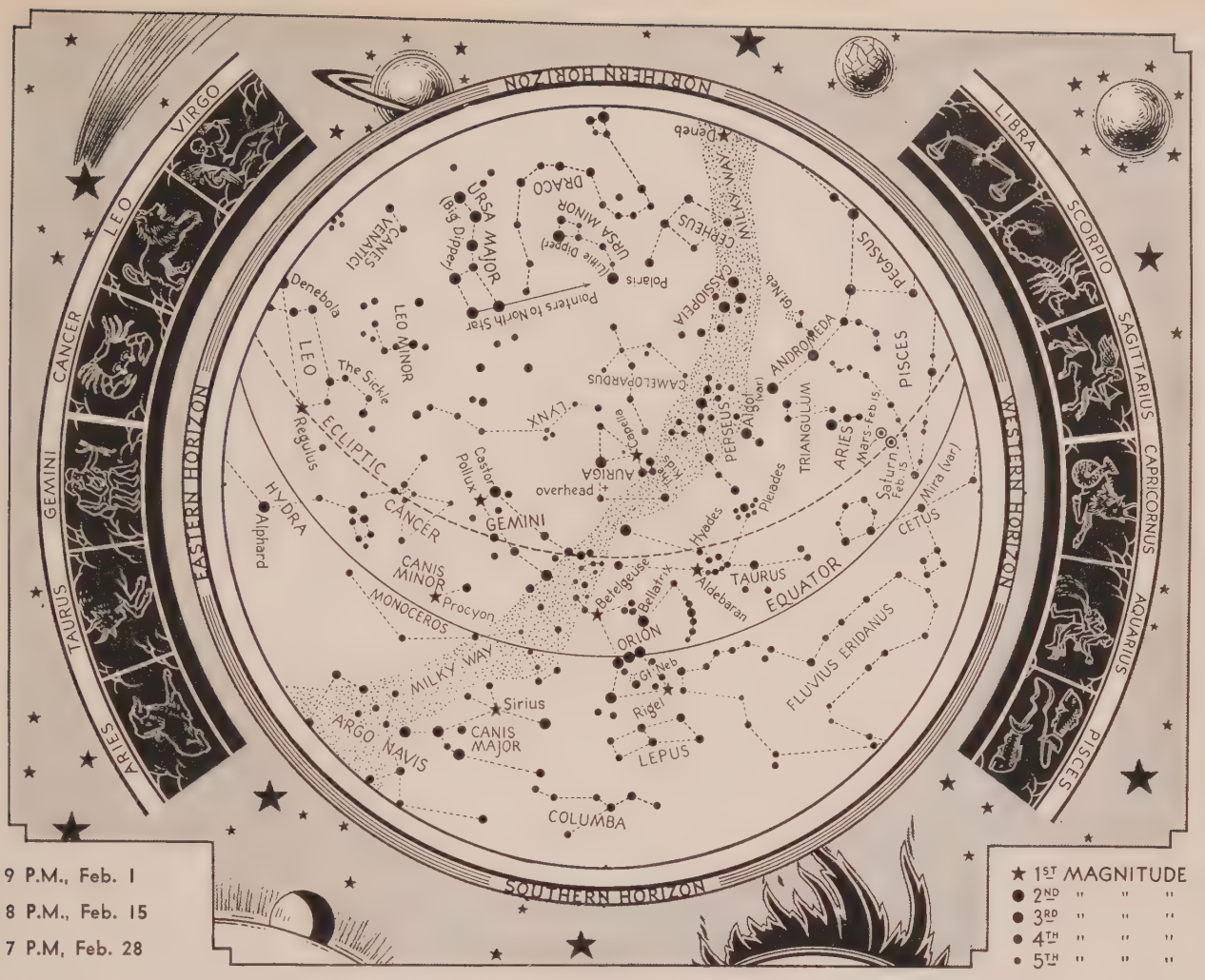
Copra, the dried meat of the coconut, once provided a rich revenue, but in recent years many plantations have failed financially through over-production. The copra is exported to Europe and America, where the oil is extracted for the manufacture of margarine, soap, and the fashionable shade of tan for bathing beauties.

It is all very romantic to gaze on the picturesque palms as they fringe the sun-drenched shores of a blue lagoon, but it is quite another story to travel on a copra boat. Every particle of woodwork, rope, furnishings, and atmosphere is permeated with the cloying odor of coconut oil, and tropic heat does nothing to improve the situation.

The frond-like leaves make excellent thatching; also coverings to protect young plants in the field from sun and weeds. Exquisitely fine hats, fans, and garments are woven from young, tender leaves. Strips from the midrib of the leaves make stout lashings.

Among the many uses of husk fiber is the making of fish lines and nets; caulking for canoes; and, on some islands in the old fighting days, helmets and armor for defense against slingstones. Where firewood is scarce the dried husks, sheaths and flowers, and the nut shells, are used.

The scene beneath the coconut palms on the accompanying stamp of Rarotonga, one of the Cook Islands, pictures the landing of the island's discoverer, Captain Cook. With the famous navigator on this eventful voyage were Joseph Banks and Dr. Solander. Doubtless these distinguished botanists were in this first group to be rowed ashore, eager to examine the wealth of tropical vegetation of the region, and to study its strange species.



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

PARADE OF THE PLANETS

By ISABEL M. LEWIS

DURING the latter part of February, and early in March, all five of the planets that are readily visible to the naked eye—Mercury, Venus, Mars, Jupiter, and Saturn—will have a most remarkable distribution in the evening sky. Also, Uranus, visible without telescopic aid as a faint star-like object of sixth magnitude, joins the picture. In fact Neptune, now in Virgo, is the only one of the planets that is not at that time in the evening sky; for Pluto, a faint telescopic object visible only in the greatest telescopes, is now in the constellation of Cancer and so is above the horizon for the greater part of the night.

The six brightest planets will be in the western evening sky. Mercury will be nearest to the western horizon and will be followed in order by Jupiter, Venus, Saturn, Mars and Uranus. The five first-named will all be grouped within forty degrees of each other and will extend in line along the ecliptic. At the beginning of the month Mercury has just passed superior conjunction, and, although in the evening sky, is very close to the sun. As the month advances it rapidly increases its distance eastward from the sun, and finally will be picked up in the evening twilight, probably by February 20 or a little later, more than a week before the date when it is at its greatest eastern elongation, which is February 28. On that date Mercury, which will resemble a reddish star of zero magnitude brighter than Betelgeuse in Orion, will set about an hour and a half after the sun.

This will be the best time of the entire year for viewing Mercury in the evening sky and it will be interesting to watch the western sky immediately after sunset soon after the middle of the month to see how soon one can pick it up in the evening twilight. Once it has been discovered it may be followed on successive evenings, when it will be higher above the horizon and brighter and more easily observable as the month passes. Even with Mercury absent in the earlier part of the month the appearance of the other four planets is most unusual. At the be-

ginning of the month Venus will be seen nearest to the western horizon, far surpassing the other three in splendor. Jupiter comes next in order, and also next in brilliancy. It lies in the southwest high above the horizon at sunset and some twenty degrees east of Venus. The two planets will draw continually closer to each other as the month advances, and, on February 20, they will be in conjunction in the early evening, Venus passing about a degree north of Jupiter.

Mars follows Jupiter at a distance of about twelve degrees to the northeast of it the first of the month, high in the southwestern sky at sunset, and is followed in turn by Saturn at a distance of only seven degrees. The reddish color of Mars contrasts with the pale yellow of Saturn. It is now about equal in brightness to Aldebaran in the Hyades, some distance to the east of it, and also resembles it in color. It may be recalled that when Mars was nearest to the earth last July it was even more brilliant than Jupiter. Its distance from the earth has increased so greatly since then that it has now dropped to the rank of a first magnitude star in brightness, and it will continue to decrease in luminosity until its splendor will not even be as great as that of a star of the second magnitude. Saturn varies little in brightness because of its great distance from the earth at all times. It is now about half a magnitude brighter than Mars and comparable to Procyon, the Little Dog-Star, in splendor.

One of the interesting features of this strange parade of the planets this month will be the conjunction of Mars and Saturn on February 13, when Mars will be about three degrees north of Saturn. These two planets, as is also the case with Jupiter and Venus, will have been drawing closer together since the beginning of the month, and they will reach conjunction seven days earlier than Jupiter and Venus. To add to the attractiveness of the scene in the western sky the moon will pass among the four bright planets from February 11 to 13. It will be in conjunction with Venus late in the afternoon of February 11 (Eastern Time). On the following day, at 9:32 A.M., it will be in conjunction with Jupiter. On February 13, at 3:00 A.M., Saturn comes into conjunction with Mars, and at 9:55 P.M. of the same day it is in conjunction with the moon. On this evening Mars, Saturn, and the moon will form a beautiful group in the western sky, with Jupiter and Venus not far distant.

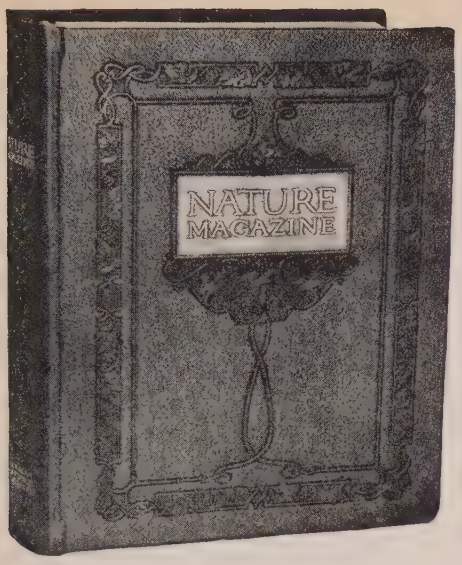
There will be no better time than this month to observe the five naked-eye planets, and to compare them in brightness with the brighter stars and with each other. Only on rare occasions may they be seen so close together and so favorably placed in the evening sky. Their distinctive colors, their motions relative to each other from day to day, the absence of twinkling, or scintillation, which distinguishes them from the stars, are all worth observing. If we could also observe them telescopically we would note that Venus resembles a gibbous moon at this time, for it has passed superior conjunction and has not yet reached its greatest elongation east of the sun. Mercury also is in the same part of its orbit and therefore gibbous until February 28, when, at elongation, it resembles a half moon in the telescope. After that date it will be in the crescent phase until it comes into inferior conjunction. Then its phase is that of the new moon. These two planets alone show all the phases of the moon because their orbits lie inside that of the earth. No distinctive markings are observable on the surface of either of them. All the interesting Martian features are no longer to be observed for the planet is now too distant from the earth and so it is of little interest telescopically. Jupiter and Saturn, as always, will delight us when seen through the telescope, the former with its satellites and belts and the latter with its unique system of rings.

Uranus, which is barely visible to the naked eye, exhibits a greenish disk in the telescope, but its small, faint disk shows no distinct markings. It is now in Aries a few degrees southwest of The Pleiades. Venus will pass during the month from Aquarius into Pisces; Mars from Pisces into Aries; Jupiter from a corner of Cetus into Pisces; Saturn will move eastward in Pisces a distance of less than three degrees. As there are no bright stars of first or second magnitude near the planets in these constellations it will be an easy matter to identify them at this time. They lie, in fact, below Andromeda and Pegasus, north of Cetus, and west and south of the two bright stars in Aries, a part of the heavens singularly devoid of bright stars.

The presence of five brilliant planets in this region at the same time is, therefore, most remarkable and adds greatly to the splendor of the winter evening sky which is considered, aside from the presence of the planets, to be the most brilliant of any season of the year. It is at this time of year that we have the magnificent Orion with its Great Nebula, and its many stars of first and second magnitude; Taurus with its ruddy Aldebaran and its famous Hyades and Pleiades; Capella, one of the finest stars of the northern hemisphere, in Auriga; Gemini, with its Castor and Pollux. Following close on the heels of Orion, the brightest of all the stars, but still never a match for Venus nor at times Jupiter, is Sirius in Canis Major, The Greater Dog, and, to the north and east, Procyon, in Canis Minor, The Lesser Dog. Between them lies that beautiful luminous band that we call the Milky Way, passing northward across the feet of Gemini and through Auriga, Perseus, and Cassiopeia, to Cepheus and the northwestern horizon. The Winter Street, they called it in some lands, and among many other names, Jacob's Ladder and The Pathway of Souls.

As February passes, the Sickle, in Leo, swings higher in the east and the Big Dipper leaves its position near the northern horizon and comes into the northeastern sky, signs the heavens give us of the near approach of spring.

A limited number of the special educational inserts entitled "The Sky at Night", published in the February, 1939, issue of Nature Magazine are available at ten cents a copy from the American Nature Association.



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Birds Around the Home

So far as we know there is no book comparable to *Birds in the Garden* by Margaret McKenny. Certainly there are few so complete as to text and picture and therefore so appropriate to be purchased by or given to bird and garden lovers. This 348-page book is dedicated to W. L. McAtee of the U. S. Biological Survey, whose studies of the food habits of birds provide its inspiration. First discussing the esthetic and economic values of birds, the author proceeds to the planting of small gardens to provide food and shelter; the similar treatment of a large garden; feeding devices; supplementary food; protection; bird homes; water in the garden; bird songs; the care of stray birds; migration and bird banding; birds on the country place; balance in bird life; birds in the city garden; hunting with a camera; bird sanctuaries and description of garden birds. Finally there is a chapter of some one hundred pages devoted to a listing of the plants that may be planted to attract birds in various parts of the country and the birds attracted by them. Sub-divisions of this chapter cover plantings to attract waterfowl and to bring birds to a city garden. Thus the text is complete beyond comparison. Furthermore, there are sixteen color plates and thirty-two pages of half-tone illustration with two to four pictures to a page. Published by Reynal and Hitchcock, this book is well worth the five dollars it costs.

Herbs and Savories

Herbs are rapidly making their way back into the garden picture, both for their decorative value and their intrinsic importance. A part of this return to favor may well be due to the interesting histories that surround them. All of these considerations enter into the text of *Magic Gardens* by Rosetta E. Clarkson, who grows all of the plants about which she writes at Salt Acres, her home on the Connecticut shore. In this fascinating book the author has dug back into old herbals for history and illustration, recipe and remedy. Anyone interested in herbs and savory seeds will revel in this volume, which is published by the Macmillan Company at three dollars.

A Pigeon Book

Carl A. Naether is professor of English at the University of Southern California and has written a book entitled *The Book of the Pigeon.* In fact, we confess to having had a desire to head this little review, "Pigeon English". Professor Naether has, now and then, contributed to *Nature Magazine,* writing about exotic pigeons and about photography, which is another of his hobbies. But pigeons have been his passion and he has kept almost every kind from ordinary scrub homers to Kings and Carneaux. He has kept them long enough to know them well, and has read and studied them and their histories; consulted with other pigeon fanciers; delved into pigeon lore from all angles. In his foreword the author says that he knows full well that no pigeon book has ever made money and he doesn't care in the least. He wanted to write a thorough-going and popular pigeon book and he has done it. The David McKay Company has published it at $2.50. It may turn out to be a pigeon best seller if effort and care and completeness have anything to do with it.

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THE SCHOOL PAGE ★★★

EDITED BY DR. E. LAURENCE PALMER

Professor of Rural Education, Cornell University, and Director of Nature Education, The American Nature Association

Landlubber Pedagogues and the Sea

In the present war, interest in the sea is high. The war is being fought on the surface, beneath the surface and above the surface. Land activity gets comparatively little attention in the headlines. Since life has been in existence on the earth, many of its problems have been associated with salt water.

Many high school and college classes, conducted in schools remote from the sea, dissect starfish, draw fucus and discuss experiments with sea urchins and pry into their private lives. If these activities displace studies of living local things, they may be inferior in value. If, however, actual material is used, some guidance is needed to derive the fullest values in natural history, ecology, morphology and physiology. So little help on the natural history of common marine forms is available that the insert in this number of *Nature Magazine* should be welcome.

Inland schools may find living marine animals in many fish markets, or their carcasses in any grocery store. Living lobsters, crabs, shrimps, oysters, clams and scallops probably are available at some time of the year in every State, even though they are not in their native element there. Some of these lonesome and despairing creatures may be made to show signs of life with a little planning and experimenting. Put on their backs, crabs, lobsters and shrimps may strive to right themselves. They may react to waters of different temperature. They may seek light or darkness. They may move variously. Parts of their bodies may be seen to move during respiration, on defense, or even in the taking in of food. In some, small associated animals may be found, such as the little crabs that occasionally live in oysters.

A salt water aquarium may be maintained in a school room if salt water is available. If full-strength sea water is diluted with fresh water, it usually proves more satisfactory. It would be well to keep an hydrometer in the aquarium, and, while normal sea water will read around 1.03, the aquarium water might well be 1.02. If the aquarium is covered with a plate of glass, new water need be added only when the hydrometer indicates this is necessary.

The problem of air in salt water aquaria is more difficult than in those filled with fresh water because marine plants are more exacting in their air demands. It is best to provide air by pumping it directly into the water constantly, or by adding it to water that is pumped out of the aquarium and promptly returned to it through the air.

All-glass aquaria are desirable for maintaining marine life. Metals such as zinc, copper or brass are to be avoided. Lead-lined pipes, or those of Monel metal, seem to be the most successful. Cheaper substitutes may be had by coating iron with asphalt paint.

Reasonably satisfactory artificial salt water may be made by adding to six gallons of fresh rain water, or distilled water, ½ ounce of potassium sulphate, 1½ ounces of magnesium sulphate, 2½ ounces of magnesium chloride, and 21 ounces of sodium chloride. This should be allowed to stand a few days before being used.

Another recommended formula for artificial sea water calls for 10 gallons of fresh water. To this is added 45½ ounces of sodium chloride, 11½ ounces of magnesium sulphate, 8¾ ounces of dry magnesium chloride, 2 ounces of calcium chloride, 1¼ ounces of potassium chloride and ⅛ ounce of bicarbonate of soda. Try two aquaria, using one formula with one and another in the other. Observe carefully to discover in which the marine life prospers best.

Any sand used on the bottom of a marine aquarium should be either thoroughly cleaned silica sand, or sand brought from a seashore.

For the keeping of animals of temperate seas, the temperature should be just below 68 degrees F.; for tropical species it may well be just above that reading.

Living star fish, sea anemones and other marine creatures, as well as sea water, may be purchased from the better biological supply houses. Some, such as the General Biological Supply House of Chicago, issue detailed directions as to the care of marine aquaria.

These marine aquaria should be understocked since overstocked units quickly become fouled. If treated reasonably, they should last almost indefinitely, some having been known to be maintained as much as forty years without having the water changed. Ground, canned shrimp will provide suitable and easily available food for most animals maintained in a salt water aquarium. As with the fresh water unit, great care must be made to limit the feeding so that there will be no surplus to spoil.

It is difficult to think of a more interesting project for an inland school than trying to establish a marine aquarium without access to the sea, and with the fish market supplying the live stock such as shrimps, clams and oysters. Failures will undoubtedly be many, but they should be instructive. If too much is not expected of the effort, the experience will be thoroughly worth while. Certainly, these efforts will be useful in prolonging the period in which the marine animals of the fish market may be studied. They will also provide more instruction than will the same animals decorating the top of a piece of ice. Not only will the science classes be helped by these experiences, but students studying geography should have a better appreciation of what a seashore is like if they can see how some of the animals of such a place live, move, and have their being.

Other vicarious sea experiences that landlubber biologists may enjoy center around determining the degree to which the sea enters into our everyday life. What ornaments do we get from the sea? What foods and medicines? How does the sea rank as a setting for our best art, literature and music? How has it helped in ancient history and how important is it in present-day international affairs? Which of its resources have been developed; which have been seriously depleted; which have hardly been touched; how may the needs of nations with respect to marine wealth eventually force them to come to agreements that might not otherwise be possible?

One might list such names as Byrd, Beebe, Jules Verne, Captain Kidd, Roy Chapman Andrews, Davy Jones, Moby Dick, Tom Cringle, Captain Bligh, Morgan, King Canute, Noah, Jonah, and the Owl and the Pussy Cat, to see what these names mean to those who have an interest in the sea. Similar and more extensive lists might be prepared to include *The Voyage of the Beagle, Two Years Before the Mast, The Cruise of the Kawa* and the voyages of Drake, Captain Cook, Doctor Cook, and others. It is admitted that the serious and ridiculous are freely mixed in the above lists.

This page has usually emphasized the studying of real things in their natural situation and here we find ourselves suggesting this month how one may make a substitute for reality. So many of our readers are, however, situated remote from the roar of surf that in this case it seems excusable. It is planned that a later insert will deal with the fossil evidence of marine life, now evident so frequently inland. There is no better story of how this subject can be handled by a landlocked high school teacher than in David Starr Jordan's "Story of a Stone" published in his *Science Sketches*. This should be read by every science teacher in the land.

Of course this page should not neglect to provide some help for those teachers who are fortunate to have access to the real sea.

If it is possible to select in advance the date at which a teacher will take a group of students along a seashore it may be necessary to select a time when the tide will be out. If this is to occur in the late afternoon it might be well to make an early morning trip during the previous low tide. At that time, unique creatures may be found alone and cached in wire cages where they may be found later when the tide again goes out. In this way, which is sort of "salting the mine", one can guarantee that certain things will be found. The writer found this technique highly useful in conducting about a hundred teachers on a field trip along the shores of the island of Oahu in the Hawaiian group. At least we found representatives of the most important groups in this way when this might have been impossible under the stress of working with many people each of whom had a different native name for almost every conceivable living thing.

Inexperienced beach-combing pedagogues would do well to spend much time watching what old-timers do rather than trying to depend from the first on their own skill. Without such help even clams in their native element are practically immune from capture.

Where the water is warm, a glass-bottomed box floating on the water in front of the wading collector will reveal animals lurking in crevices and which would ordinarily be invisible because of the light reflected from the surface of the water. This is probably the most useful field-gadget for an amateur collector. A long-handled, child's garden rake will save many backaches, and a good-sized basket, possibly with a bottle of formalin preservative, will be useful. Once started with such equipment, and with a good beach, the amateur naturalist will let himself in for a series of experiences that he will want to renew at every opportunity.

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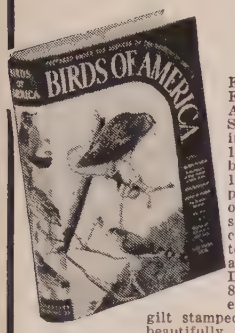

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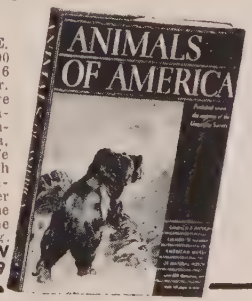

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Caribbean Treasure

A few years ago a book called *Animal Treasure* came from the pen of Ivan T. Sanderson. It was a fascinating account of the findings of a British expedition into the Cameroons of West Africa. It attained a popular reception due to the charm of the text in presenting the information gathered in the trip. Now comes a second volume by Mr. Sanderson, this time with the title *Caribbean Treasure*. This one is based upon studies of the fauna of the almost unknown back country of Jamaica, Trinidad, Haiti and Dutch Guiana. Mr. Sanderson does not seek out the "believe-it-or-not" type of wild life, but has such a notable ability at observation and study that his reports on the native wild life need no touch of the bizarre. Besides his accomplishment as naturalist and writer, Mr. Sanderson is also an artist, and a delightful feature of this book—and its predecessor—are his illustrations. Mr. Sanderson's publisher is the Viking Press, and the price of the book is three dollars.

A New Magazine

For many years Mabel Frances Whittemore worked in the Nature study field in Canada, and made a lasting contribution to its progress. Her untimely passing left much of her work uncompleted, and that it may not be allowed to lapse her husband, A. R. Whittemore, Toronto publisher, has founded *Canadian Nature*. This is a bi-monthly publication devoted to Nature and Conservation and designed to carry on the inspiration of Mrs. Whittemore's leadership in this field. The first issue is dated September-October, and attractively and effectively presents material for school Nature work. We welcome this newcomer to the field of Nature education and wish it long life and broadening influence.

Education Through Verse

There is a somewhat different idea in *By the Side of the Road,* a book of poems by Harriet R. Greenland. In it she has assembled many simple little poems that paint a picture, point a moral or impart some useful item of information. They suggest the wisdom of giving youngsters in the elementary grades their start in Nature appreciation and conservation through such a rhythmic medium as this. We don't believe that this has been tried before, and it might be that a somewhat more integrated program—as the pedagogs would have it—would be desired, but it strikes us that Miss Greenland has hit upon something that makes her little book stand out from the usual run of volumes of collected poetry. Published by the Christopher Publishing House, Boston, this book is listed at $1.50.

Minerals, Metals and Gems

We assume that A. Hyatt Verrill must take off time to eat and sleep, but judging by his recent output of books he must spend the rest of his time at the typewriter and in the library. Author of a series of "Strange" books and with three more in preparation, according to his publishers, L. C. Page and Company, Mr. Verrill has taken a slight literary detour to produce *Minerals, Metals and Gems,* a simply-told and popularly-presented book in a field in which there is currently a resurgent interest. The book sells for three dollars.

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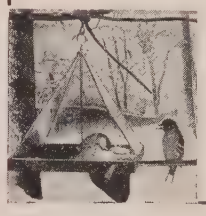

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The Association will pay expressage or postage when films are shipped to customers. The customer will pay return mailing charges and will be responsible for films until returned to 1214 Sixteenth Street, N.W., Washington, D. C. Rentals will be shipped C. O. D. unless paid for in advance.

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CAMERA TRAILS

(Continued from page 67)

Enlarging Booklet

Any photographer who is making enlargements is interested in the technique and in the materials and equipment best adapted to the making of really good pictures. To this end we have arranged with Burke & James Inc., to supply readers of Camera Trails with a quantity of their new enlarging booklet which ordinarily sells for 25c. It includes seven pages of valuable hints on the technique of making big-ones-out-of-little-ones, an especially interesting page on the lighting system used in enlargers, a catalogue not only of the Solar Enlargers but also of almost every accessory and gadget that might be needed in the process. This booklet will be sent to all readers of this department. Write to Camera Trails and enclose a 3c stamp for mailing.

This and That

The General Electric Company has announced a new, tiny flash bulb #5, which has a base similar to those on automobile headlight bulbs. It has about three-quarters the power of their #11 bulb, and is so small that an unbelievable number can be stowed away in the Nature photographer's case. If your dealer has not received these bulbs, write to General Electric, Nela Park, Cleveland, Ohio.

James H. Smith & Sons Corporation of Griffith, Indiana, have introduced a portable light-reflecting device—the Victor Sunflector. This will interest Nature photographers. It is a convex mirror with an adjustable stand that enables us to throw a beam of light into dark spots that we otherwise might have difficulty in reaching, and will be useful especially for those animal den and birds' nest shots that are usually so hard to light properly. Write to the above company for information concerning the Sunflector, and do not forget to mention this department.

Don't forget that, when the tap water runs as cold as it does at this time of the year, we must not skimp on the wash time of films or paper. An emulsion that has not been sufficiently washed will either fade or become stained.

Willoughby's, Inc., 110 West 32nd Street, New York City, have announced a new 100-page Equipment and Accessories Catalogue. Write to them for your copy.

It may interest the Nature photographer to know that Graflex and Speed Graphic Cameras may now be purchased from all regular Eastman dealers on a time payment plan with 20% of the purchase price down and the balance spread over a year. Other manufacturers, we believe, are now or soon will be adapting a similar plan.

Haber & Fink of 16 Warren Street, New York City, have a mailing list to whom they send bulletins from time to time, illustrating the newest equipment, price changes and special bargains in used material. To have your name entered on this list, write to the above company mentioning Camera Trails.

The Nature photographer who mounts his pictures will find Fotoflat valuable. For full information on this dry mounting plan, write to Seal, Inc., at Shelton, Connecticut, mentioning this department and asking for full details.

Don't delay in entering your pictures in the Camera Trails' Contest. Time marches on!

This department is operated for you and maintains a service to assist you in the solving of your photographic problems. Its editor will also appreciate your criticisms and suggestions as to the things you would like to have discussed in these columns. Address your communications to Norris W. Harkness, Camera Trails, Nature Magazine, 1214-16th Street, N. W., Washington, D. C.

DOGS OF FAME

(Continued from page 87)

such stories fly back and forth just as fish stories do among fishermen. To one who draws and writes about dogs, as I have done for so long, thousands of stories come in the natural course of events. Set in type, they would rival the encyclopedia in shelf space demanded, but type would not do justice to most of them. The real story is engraved in the heart of the master or mistress of the dog. It is better that these obscure friends, whose eyes and tails and barks are their only language, be thus immortalized.

But Fast Enough

If you love New England and love Nature you will love *Not Faster than a Walk* by Viola C. White. When he read the proofs, before writing a preface, Walter Pritchard Eaton says that his first impulse was to exclaim, "Thank God for a woman who can walk!" Anyone reading this charming diary of life in Vermont will echo this sentiment and feel that Dr. White, travelling no faster than a walk, was going fast enough to distil thoughts of beauty and charm and interest from things most of us miss. She watched with individual affection several notable icicles, observing, on December 5: "My fine big icicle slid off the roof last night and broke its neck." Or, noting that one Vermont woman was urging the Legislature to eliminate all bears in the State, Dr. White quotes from Muir's Journal, *John of the Mountains* and gently decimates the protestant. Or, on June 19, she "walked down to the creek before dinner, pleased, though not at home, in the luxuriant undergrowth. Found swamp milkweed almost in the water, with glowing crimson buds. I wish someone would pay me for doing nothing except appreciate Nature. There ought to be at least one official appreciator for every ten square miles." Here, indeed, is a lovely book, walking around the calendar from October 1 to September 30. Published by the Middlebury College Press, Middlebury, Vermont, it is priced at two dollars.—R. W. W.

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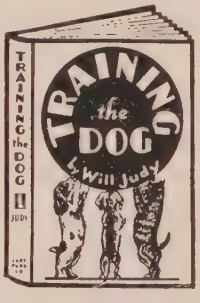
EVERY dog is entitled to proper care and, above all, to proper training. His wonderful mind should be developed to its fullest extent. Particularly in obedience so that his own life will not be lost through disobedience.



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ON THE RECORD

Music of the jungle, produced by jungle people, is primitive and close to Nature. It reflects the simple musical urge of people who live intimately with Nature; it expresses the essential rhythm of the wild. Alleged tribal music often has been reproduced by modern orchestras, but these efforts lack the authenticity of the original because man, who calls himself more civilized, cannot help adding his own touches to the original.

It is no longer necessary to rely upon the modern orchestra leader's conception of the African jungle's "swing" tunes. One of the many things brought back from the Dark Continent by the recent Straus West African Fxpedition of the Field Museum of Natural History are recordings of native music made on the spot. These were acquired by Laura C. Boulton, who can take pride in a most unusual group of records. Six ten-inch records now preserve songs of praise, ceremonial songs, war horns and drums, and other native songs. The recordings were made in the French Sudan, Nigeria, Timbuctu and the British Cameroons. These records are valuable educationally, to collectors of outstanding items and to students of music. They are issued as a group in Album P-10, Records 84-89.

•

Mrs. Boulton appears to have started a vogue, for another expedition has left for Africa to film and record the music, folk lore and customs of African natives in their natural habitat. This is a two-year expedition led by David Griffin, president of the World Travel Club of Rochester, Minnesota. The party is armed with a two-year supply of film and recording blanks, with recording equipment made specially by RCA.

•

"Gulliver's Travels" having now made its bow as a full-length, color cartoon film with music, records are now available giving the high spots of the action of the unique film. There are three ten-inch Bluebird records and the entire musical score of the picture, with its eight charming songs, are all recorded.

•

Even books talk now. Heretofore the closest approach to such a development were the recordings of bird songs by Brand that came as a part of a book on bird songs. Just as the sound film came before the talkie, the sound book has come before the vocal volume with the appearance of *Mother Goose Parade*, published by the Garden City Press. This book is Mother Goose illustrated in color and supplemented by a record to be played as the child thumbs over the book. Thus the Old Woman Who Lived in a Shoe comes to life along with others of the Mother Goose parade. The story was written by Carolyn Adams, noted author of fairy stories, and the accompanying music was written and sung by Alice Remsen, famous as the "Musical Story Lady" of radio.

•

RCA-Victor has announced a new develop-

ment in a machine that talks. They have christened it the RCA-Victrola Jr., and it is an amazingly compact little machine that has its acoustical speaker built into the tone arm. This machine is constructed for a tough life at the hand of the younger members of the family, but it boasts a surprisingly fine tone quality for such a little machine.

•

When looking over the record catalog at your local dealers do not overlook the specialized listings of records relating to birds, mammals, insects, flowers, trees and pets. Many of these are not widely publicized but are well worth having in your record library.

Forbush and May

In 1925 the Commonwealth of Massachusetts began the publication of the three-volume work, *Birds of Massachusetts and other New England States* by Edward Howe Forbush. In 1932 the State published *Portraits of New England Birds*. Some of the volumes of the former are now unobtainable, and the latter is out of print. Now, revised and abridged in some directions, and expanded in others through the inclusion of more than one hundred species, comes *Natural History of the Birds of Eastern and Central North America*, drawing upon these previous publications. The additions have been made by John Bichard May, who also contributed the revisions and abridgements. The result is a one-volume work of 554 pages, plus 97 colored plates by Louis Agassiz Fuertes, Allan Brooks and Roger Tory Peterson. The publication was made possible by legislation fostered with the Massachusetts General Court by the Massachusetts Audubon Society. We are therefore indebted to that organization and to Houghton Mifflin Company, the publishers, for making this fine volume available at the modest price of $4.95.

A Danish Hare

To this country from Denmark by way of England comes *The Grey Hare* by Svend Fleuron. It is a story of the wild life of the Danish fields and the skies immediately above them. Published originally in Danish, it was translated and published in England, where it found a pleased audience. This is not surprising since it is a charmingly written story by a man who has become known as Denmark's leading writer about animals. It reveals a deep understanding of and sympathy for wildlife, telling of the romance, drama, tragedy and humor of the wild with Josse, the hare, as the central actor. Published in this country by Farrar and Rinehart, this entertaining little book is priced at $1.50.

Muir Woods

Custodian of the Muir Woods National Monument from 1930 to 1938, J. Barton Herschler gradually assembled material for a booklet on this beauty spot, which has been preserved for posterity. His duties were such, however, that he was not able to complete this work until he had been transferred to the ranger service of Rocky Mountain National Park. An attractive 40-page pamphlet has now been published by Mr. Herschler and is available to those who have been to this monument, are going, or would like to go.

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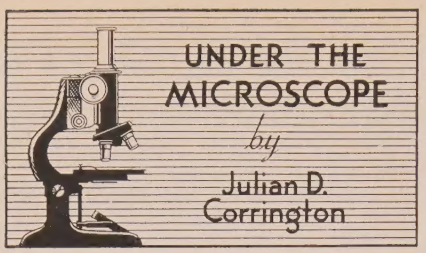


Bacteria: Pure Cultures and Staining

A pure culture is one containing only a single species of micro-organism, such as a bottle or dish of *Amœba proteus* without any other protozoa at all, or a test tube with *Proteus vulgaris* as the sole bacterial occupants. Isolating an Amœba in order to start a pure culture is not a particularly difficult task under a binocular microscope, but when it is stated that just one tiny loopful of fluid from a contaminated source, or from a mixed culture of bacteria, may contain from two to three billion single bacteria, representing a number of species, it would seem a hopeless job indeed ever to isolate an individual specimen from such a mass, yet it can be done with ease by either of two methods.

These methods are termed plating and streaking, and result in the growing of a colony from one bacterium. For *plating,* have ready three empty but sterilized petri dishes and three test tubes of sterile and incubated agar medium, as discussed in our previous installment. Also needed is one inoculating needle (not a loop) made of either platinum or inchrome wire, which is always to be flamed before and after use, as was done with the loop.

Allow the tubes of medium to cool to 45° C., at which temperature the agar remains melted. Dip the tip of the needle to the depth of about one-third inch into any fluid you may have at hand that contains bacteria, then using all of the precautions we have specified in regard to inoculating under sterile conditions, dip this needle into tube number one and rotate the needle a few times by gently twirling between the thumb and forefinger. Without sterilizing the needle it is now used to inoculate tubes numbers two and three, in succession, in the same manner. Plug each tube and then rotate each, while held upright, between the palms of the two hands in order to mix the bacteria with the agar.

Take tube number one out of its rack and hold, unplugged, in the right hand. With the left hand lift up the lid of petri dish number one on one side and just sufficiently to permit pouring contents of tube into dish. Do this quickly and immediately put on the dish cover. Repeat with tubes two and three, pouring into dishes two and three. To keep tubes and dishes straight the numbers should be indicated by labels or a glass-writing pencil of yellow wax. Let the three dishes cool, then turn them upside down and incubate them in that position.

The first dish will show a heavy infection, the other two progressively much less, with fewer and more-scattered colonies. Each colony results from the growth of a single bacterium and hence represents a pure culture. From the second or third dish it will not be difficult to pick up a portion of one colony on the tip of the sterile needle and transfer to a fresh tube of nutrient medium, where it should grow vigorously upon incubation.

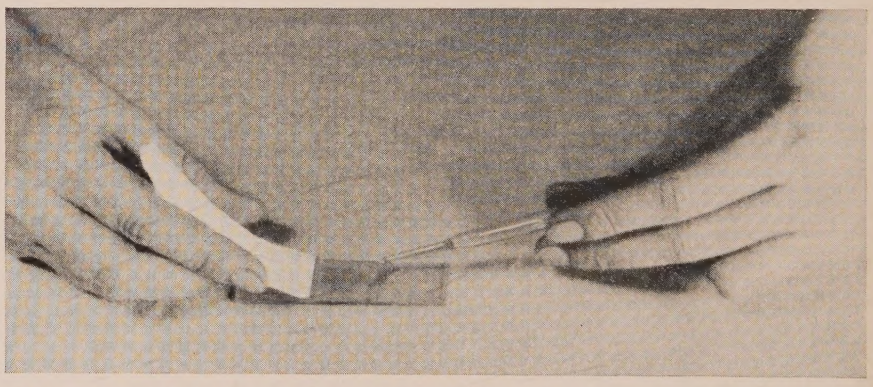
Streaking is simpler and preferred by many. In this method the petri dishes are inoculated, rather than the test tubes. Melted agar is poured into sterile dishes, as before, and allowed to cool. Then a small sterile glass rod or the flamed wire loop (not the needle) is dipped into the infected source for specimens and stroked across the solidified agar surface in the dish in parallel lines, about one cm. apart, without injuring the surface of the agar. Upon incubation colonies spring up along these lines, being farther apart as one proceeds toward the last row, and here and there will be found pure cultures from which a bit may be picked up with the needle and transferred to a culture medium and incubated.

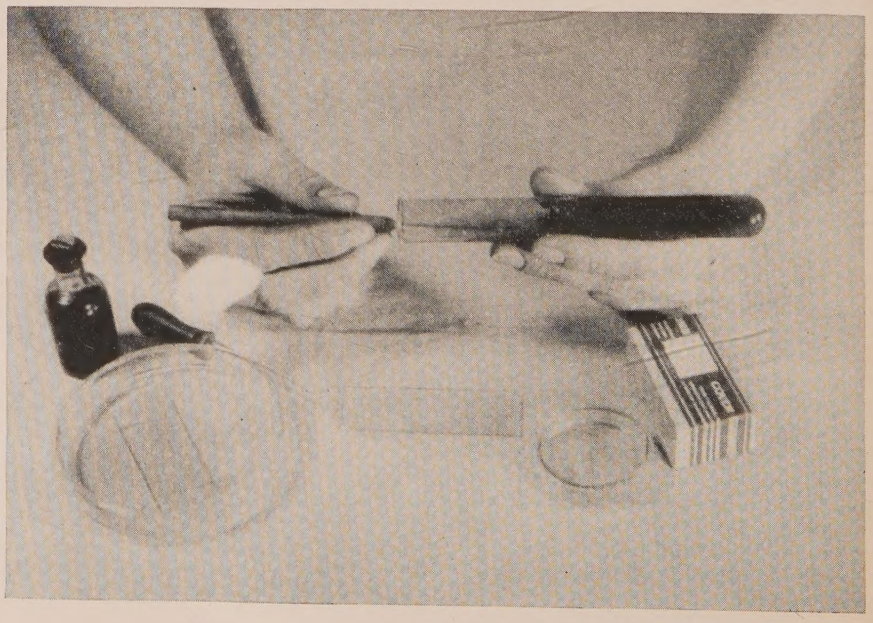
Thus are bacteria obtained and reared. Studying and identifying the many species under the microscope is another matter, and calls for staining and the making of permanent slide preparations. Such slides are of many sorts, for various purposes. They may be made directly from the original source without culturing, in order to show the bacteria present, as in pond water, sewage, soil infusion or saliva; or one may desire a slide to show one species only, made from an incubated pure culture. Still other slides may receive special treatment to bring out such structural features as spores, capsules and flagella, while thin sections of organic tissues from infected animals or plants can demonstrate the bacteria of a given disease as they occur in the body.

Let us first make a regulation species slide from one of our pure cultures. Flame the loop and pick up a loopful from the incubated tube or slant of medium. On the table before you should be several thoroughly cleaned and flamed slides and cover glasses, one of the latter held by preference in a cover-glass forceps, an instrument that will keep a cover elevated slightly above the table, and level. With the loop, spread the bacterial culture in a thin film on this cover glass or, lacking such a forceps, upon a glass lying flat on the work bench. Permit the film to dry in the air, then kill and fix the organisms by passing the cover three times rapidly through the apex of a flame—about one-half second each time, and film side up so that the flame hits the side opposite to that on which the material has been smeared. If the bacteria have been taken from a solid medium, obtain a loopful and stir this up in a drop of distilled water on a cover glass. The best slides are made from young cultures, 24 to 48 hours old.

A favorite and simple method of staining such films employs gentian violet or crystal violet as a saturated solution in 95A; 1 gram of the dye will saturate 20 c.c. of the alcohol. Next prepare anilin water by shaking up 4 c.c. of anilin oil in 90 c.c. distilled water in a bottle, and filtering through a wet filter. Add 5 c.c. of the gentian violet solution to 50 c.c. of the anilin water, shake well, set aside for 24 hours, then filter and bottle. Solutions of this and other dyes made up in anilin water will only keep for about ten days; after this time they begin to decompose and fresh mixtures should be made.

Stain the film for 5 minutes, rinse by allowing a very gentle stream of tap water to trickle over the cover glass, plunge into 95A for a moment to destain, drain off excess alcohol,





ABOVE, STAINING SMEAR BY DRAWING STAIN UNDER COVER GLASS WITH BLOTTING PAPER. BELOW, METHOD OF REMOVING SAMPLE OF CULTURE FROM CULTURE TUBE

lot gently with a piece of filter paper, pass ne cover, film side up, through a flame to ry completely, then mount by inverting the over over a slide on the center of which you ave placed one medium-sized drop of fairly in balsam. Some technicians prefer making ne smear on the slide rather than on the over.

A somewhat longer but more exact technique is the Gram stain, not only as an excellent general stain but also as a differenator. Treatment with an iodine solution preares certain bacteria so that they retain the entian violet during decoloring while others ive it up. Those species keeping the stain re termed Gram-positive while those that se the violet are Gram-negative. Prepare a lm and proceed to stain in anilin-gentianiolet as before and rinse in water. Now flood ne cover glass with Lugol's iodine solution or 2 to 3 minutes until the stain is black, nen wash with 95A until the stain ceases to ome away freely—usually 30 seconds to one inute. Rinse in water again and counterain with a 1% aqueous solution of safranin r basic fuchsin. Wash off excess counterstain n water, dry and mount in balsam; or after ounterstaining, rinse in absolute alcohol, lear in xylene and mount in balsam.

Some experimentation with this technique s necessary to get the intensity of the violet olor just right, and most workers prefer to xamine the cover glass, placed face up on slide for the purpose, under the microscope, fter rinsing but before counterstaining. If the iolet is too light, repeat or discard and stain ne next one longer or give less time in the 5 alcohol; if too dark, bleach further with ne alcohol. About 10 seconds in the counterain should be right, and this step is optional nd may be omitted if preferred. Lugol's soluon is made by mixing 1 gram of iodine ystals and 2 grams of potassium iodide with 00 c.c. of distilled water.

Another popular stain is Loeffler's alkaline ethylen blue, made by saturating methylen lue in 95A—about 0.3 gram is sufficient. ne part of potassium hydroxide (caustic otash) is next taken with 10,000 parts disilled water, making an extremely weak potash olution. Mix 70 c.c. of this with 30 c.c. of e methylen blue solution. Stain films from to 5 minutes with this mixture, rinse in ater, dry thoroughly and mount in balsam.

This concludes our present series on general ethods in bacteriology, but from time to me we will give directions for some of the ecial stains.

Beginner's Primer

Continuing our survey of insect classification from the November, 1939, issue, we ome to the Order Isoptera (equal wings) mong those having an incomplete metamorhosis. This is a compact group of only one rt of insect, the famous termites or so-called white ants". Actually they are not at all reted to ants, and resemble these higher incts only superficially—in size, general form nd social habits.

If you can collect some specimens, compare em with an ant and note the differences. onstrictions between body regions, so proment in ants, are far less marked in termites; nts have an elbow joint in the antenna not en in the other insect; the cuticle or outer overing of ants is tough and dark, enabling em to resist drying out and to live in almost ny environment, from frigid regions to the tropics, desert, plain, forest or mountain, while in termites the cuticle is delicate and whitish and unable to stand exposure to air, hence they inhabit mainly tropical and humid situations and seldom are seen abroad, dwelling underground or in wood. Ants have stings, termites do not.

In both types the mouthparts are adapted for chewing, and wings, two pairs in number, are restricted to the reproductive individuals —the kings and queens—and are shed after mating flights have taken place.

Both ants and termites are social insects and live in colonies, but here the resemblance in habits ceases. Kinds of individuals differing from one another structurally are termed castes among social insects and the more primitive termite outdoes the far more highly organized ant in this respect, having two reproductive castes plus worker and soldier castes. Should the primary king or queen termite die, there are complemental ones to take their place.

Unless you make a special study of the termite nest, the castes you will see will be the workers and soldiers and these make excellent and interesting whole mounts. Each of these represent both sexes, with undeveloped reproductive organs, whereas in ants the workers are all undeveloped females. Termite soldiers have enormous heads with huge mandibles and are supposed to protect the colony, although they seem rather ineffectual in their attempts to do so.

To many persons, chief interest in termites centers around their destructive attacks upon timber. They live mostly in dead wood or processed lumber, though many are the records of their depredations in young orchards of oranges and pecans in the South. By eating out the walls and foundation timbers of buildings, termites have ruined many houses, and they also attack furniture and books. Cases are not infrequent of their entering a table through the floor beneath, eating their way up through the legs and undermining the top, without a visible sign of their presence on the surface. After they have done a thorough job, the apparently sound and perfect table may crumble to pieces beneath even a slight weight placed upon it.

The termite problem is a serious one in many southern localities, and means of treating timbers have been devised to prevent or discourage their unwelcome visitations. In many cities there are companies making termite eradication a profitable business, and it is both startling and amusing to the winter resident from the North to answer the doorbell and meet the uniformed employee who asks "Any termites today?"

Aside from slide preparations of termites themselves, chief interest in microscopy centers around certain species of flagellate protozoans that dwell in the intestinal tracts of termites and the woodroach and make it possible for these insects to enjoy the questionable distinction, along with the protozoa, of being the only animals on earth that can digest wood. We plan to tell you more about this association in a later issue, with directions for securing and mounting these protozoans.

Microbiographs

What has become of all the thousands of specimens of microscopic writing on glass that were turned out by the Londoner, William Webb? With few exceptions they, like

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Leeuwenhoek's microscopes, have disappeared without a trace, constituting one of those intriguing sidelight mysteries in the history of science.

Webb had mastered the old Gurney system of shorthand and used to do Law Courts reporting. In these precincts he was known as an appealing and educated gentleman, short in stature and with snow-white beard and hair. Among the most lasting impressions he created upon those who met him was his perfect cleanliness—everything about him was spotless and a faint aroma of soap accompanied his comings and goings.

Inventing a machine for writing on glass in unbelievably minute dimensions, he forsook the Law Courts in the hope that his new work would bring him fame and fortune. Fame of a sort he did acquire, but, alas, not the fortune. He had a premonition that he would die on a certain day of a certain year and when that time arrived he destroyed his ingenious machine, went to a hospital, and there proceeded to depart this world on schedule.

Among his achievements was the writing of the Lord's Prayer on a microscope slide in so small an area that it has been mathematically demonstrated that the entire Bible, done to the same scale, could be written out in full five times within one single square inch! This makes most of the "believe it or not" stories fade to the commonplace. Webb wrote letters, epigrams, quotations and inscriptions by the hundreds in these small proportions, requiring the high power objective for their reading, but these specimens rarely crop up in slide collections today.

We are indebted to the Watson Centenary booklet for the above account. Can any of our readers supply further facts about this interesting man?

Trade Notes

One year ago we offered for distribution Bausch & Lomb's catalog of Microscope Accessories. A new edition has just now appeared and so we are announcing it again. The booklet consists of 28 pages, profusely illustrated, and lists all sorts of objectives, eyepieces, condensers, micrometers, mechanical stages, hæmacytometers, camera lucidas, polarizing equipment and miscellaneous items. Every microscopist should have one of these fine catalogs and all you need to do to secure your copy is to send a 3c stamp to Julian D. Corrington, NATURE MAGAZINE, 1214 Sixteenth St. N.W., Washington, D. C.

We are much impressed with the organization of material, style of writing, and illustrations of a new high school text in the physical sciences written by three teachers at Pasadena Junior College. *Our Physical World* by Eckels, Shaver and Howard, pp. xi, 801, figs. 436, is a splendid job of compiling, arranging, writing, illustrating and printing, from cover to cover.

There are 12 units, taking up matter and energy, atoms and molecules, motion, heat, electricity, sound and the like, and surveying astronomy, geology, mathematics, physics and chemistry, but not in the older fashion of discreet more or less unrelated chapters. Rather everything is related to the common environment of the modern American youth and the aim is to create a philosophy in the mind of the reader which will harmonize with his daily life in a world of complex and changing science. All fields are taught as one, closely interrelated, and the work is a pioneer one that has been tried out successfully for a number of years.

Teachers of the physical sciences should by all means examine a copy and we recommend it strongly to our other readers who wish an up-to-date background. Benjamin H. Sanborn & Co., 131 Clarendon St., Boston, Mass. $2.20.

Nearly every teacher of biology, at one time or another, has succumbed to or fought down the yen to write a textbook. Fortunately most of this army of potential authors are discouraged from perpetrating their brain child because there are already too many texts and generally they are much alike. Why write just one more rehash of the overworked subject? It doesn't seem possible to write one that will be entirely different.

When we received a review copy of Cyril E. Abbott's *Basic Biology* we wondered at the title and soon were surprised to find that we were reading a really different kind of text. The author takes as his premises (1) that biology is a subject in its own right and not merely a combination of one semester each in botany and zoology, (2) that many previous texts have been hodgepodges of these two divisions, poorly or not at all integrated, (3) that an excellent integration is possible through a physiological approach, and (4) that such a course can provide adequate subject matter for the student who will take no further biological work as well as for those intending to pursue the subject, through advanced courses, for both cultural and professional purposes.

We believe that Professor Abbott has worked out these principles very effectively and that teachers of all types of biology at the college level will find this volume well worth inspection, and agree that a course of this sort must be both interesting and instructive. The material is brief and would thus work in well for those who wish their students to supplement the text with a considerable amount of collateral reading. Mimeoprint and photo-offset reproduction, notebook size, craft covers and spiral wire binding; pp. iii, 111, illustrated. Burgess Pub. Co., 426 S. Sixth St., Minneapolis, Minn. $2.00.

Under the Microscope is a department of NATURE MAGAZINE designed for those readers interested in microscopy and maintains a service to render assistance with problems in this field. You are invited to take advantage of this service. Address all inquiries to Julian D. Corrington, NATURE MAGAZINE, 1214 Sixteenth St., N.W., Washington, D. C.

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On November 26 the Allentown, Pa., *Call-Chronicle* gave the ASAM a very good write-up in describing the formation and work of our first local group, the Jansen Chapter. An accompanying photograph showed the President and organizer, Marlowe W. Hartung, Jr., first member of the ASAM, at work in his home laboratory.

This reminds us to remind you that a little publicity won't do us any harm. If you can secure space for an article in your local paper, drop the Secretary a card and he will mail you the latest edition of the Information Sheets, containing plenty of material for a feature article. Such notices are interesting to the public, will bring in more members, lead to the formation of more Chapters, and perhaps dig us up a patron or so. Now that we have demonstrated our stability, we need backing from a few persons of means who can be interested and who have faith in the future of microscopy and science, and who will get behind any movement that encourages young people and amateurs of all ages.

We have a second offer of materials to announce to members this month—samples of commercial furs sent without charge to the Society by Garry Weingarten, 621 16th St., Huntington, W. Va., a member who is a chemist with the Southern Laboratories, and who has been enthusiastic about the ASAM from the beginning. Here is the list: Beaver, Beaverette, Black and Brown Broadtail, Gray, Black and Brown Caracul, Dyed Coney-Sealene, Summer Ermine, Silver Fox, Fitch, Brown Lapin, White Lapin-Coney, Leopard Cat, Mink-dyed Marmot, Natural and Brown-dyed Poney, Natural, Dyed and Brown-dyed Squirrel, Jap Mink, Raccoon; a total of 22 items.

To get these specimens for study or mounting as permanent slide preparations, secure a number of coin or glassine envelopes and write on each the name of the fur you wish. Enclose all of these small envelopes in a larger one, stamped and self-addressed, and send the whole to Mr. Weingarten. You may ask for as many of these as you wish, and such requests will be filled in the order received, as long as the supply lasts.

Ever since our organization was effected your Secretary has been trying to discover some means of distributing the monthly catalog or booklet offering to members without the necessity of their writing in each time to make a separate request. And so we think it best now to announce that it cannot be done. Our membership nears the 400 mark at this writing and free literature cannot be secured from firms in such large quantities; the expense to them is too great. Furthermore, by no means all members would be interested in every such publication and much time, materials and postage would be wasted. So write in and send your 3c stamp whenever an announcement appeals to you as worth this small effort; and don't forget, please, for this purpose notify the Secretary at the Washington, D. C., address; he does not have any of these catalogs at the Chestertown, Md., headquarters.